

A REVISION OF AUSTRALIAN RECENT
AND TERTIARY TURRITELLIDAE
(GASTROPODA: MOLLUSCA)

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Plates 26-30

ABSTRACT

A description is given and comparisons made of all known recent species in the family Turritellidae from Australian waters, together with all known species from the Tertiary of Victoria, South Australia and Tasmania. Four (one new) species are included in *Archimediella*, 19 (7 new) in *Colpospira* (*Colpospira*), 4 (one new) in *Colpospira* (*Acutospira*), 8 in *Colpospira* (*Platycolpus*), 5 in *Colpospira* (*Ctenocolpus*), 8 and one new subspecies in *Gazameda*, two in *Haustator* (*Kurosoiia*), five in *Maoricolpus*, one in *Stiracolpus*, one in *Turritella*, one in *Zeacolpus*, one new species in *Zeacolpus* (*Stiracolpus*), one in *Pareora*, one in *Zaria*, 3 in *Glyptozaria*, and 2 in *Kimberia*.

INTRODUCTION

During the present century the recent Australian species of the family Turritellidae have been greatly neglected, due possibly to a lack of material in some instances on which to base any systematic work on the group, and also possibly because of its complexity. What little work has been done, has been in some instances misleading and confusing. Generally speaking the bulk of the species are so variable that a systematic microscopic examination of live-taken specimens is necessary to determine their exact relationship with each other, but in many cases these would be almost impossible to obtain. This paper is therefore designed to clear up a number of misconceptions regarding various species, and chiefly to collate the knowledge regarding all Australian species, both recent and fossil, in the one paper for the first time. A number of recently discovered species, chiefly from deep water, and also two Tertiary fossils are described and named.

Fortunately the dredging carried out by H.M.A.S. "Gascoigne" in 1962 in southern Australian waters, and the results obtained by the "Western Australian — Hawaiian Expedition" in the same year off the coast of Western Australia, have assisted in throwing a great deal of light on a number of species, and brought to notice three new species and a number of new records. Valuable material was also obtained from the Division of Fisheries and Oceanography, C.S.I.R.O., Cronulla, N.S.W., during a survey of the continental shelf down to 100 metres. In addition recent trawling and dredging in the somewhat deeper waters of southern Queensland has brought to light a further seven new species.

The excellent revision of the genera of this family by Marwick (1957) has enabled some order to be restored to the rather haphazard classification of the Australian species previously existing.

No new genera have been introduced as it is considered that all Australian recent and fossil species fit well into existing genera and subgenera. It has been found necessary to pay close attention to geographical limits imposed on most species of such sedentary molluscs, especially those with large paucispiral protoconchs indicating only a benthic existence. Close attention has also been paid to the possible ancestry of recent species which may be evident in the Tertiary of southern Australia and New Zealand, and any temptation to show connection with European or American species avoided without just cause.

Subfamilies, genera and subgenera have been set out in tabular form in the order of Marwick's (1957) classification, with the addition of one new subgenus introduced since that date.

Owing to the discrepancies and terms used in such varied manner by different authors in their description of species, it has proved most difficult in the past to compare species, especially when endeavouring to identify them from descriptions alone. The six to ten words in Latin frequently used by Linnaeus contrast markedly with the voluminous descriptions of Watson in the "Challenger" reports (1886). It was therefore decided that for the sake of clarity it was better to use a brief uniform diagnostic description for each species, except in the case of new species where a fuller description is given. Under the heading "Discussion" each species is compared with its nearest relatives if any in order to simplify recognition.

IDENTIFICATION OF GENERA AND SPECIES

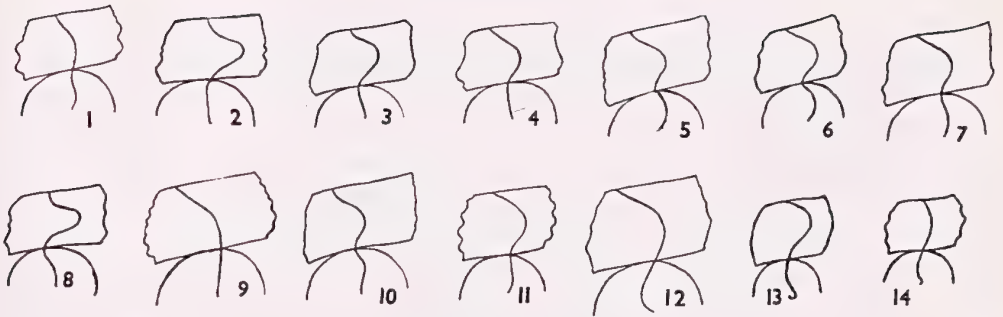
Briefly the main points to observe in generic and specific determination in this family are:

1. The protoconch, which remains fairly constant within species (with the exception in Australia of *Gazameda declivis* Adams and Reeve), but may vary to a small extent within a genus. Outlines of various protoconchs applicable to Australian species are shown below. Most genera in which Australian species are placed have paucispiral types of protoconchs, with the nucleus and portion of first whorl deviated at an angle of 20° to 40° from the axis of coiling of the following whorls. These protoconchs are referred to in the descriptions of genera as asymmetric.

2. The lateral sinus in conjunction with the basal sinus, which remain fairly constant within a genus. Drawings of the outer lip of genera and subgenera applicable to Australian species have been adopted from Marwick (1957: 146) with his permission and are shown below. It must be noted that geronticism may cause marked variation in the depth and also to a slight extent in the position of the lateral sinus on the mature whorls, and the outer lip trace on the earlier whorls is a safer guide if visible. In many specimens of *Colpospira* species the lateral sinus narrows and deepens to such an extent on gerontic whorls that it is indistinguishable from that of *Spirocolpus*, and the basal sinus would then assist considerably in determination of the genus.

In accordance with accepted practice, where an arc leans to the left when drawn from the upper suture across the wings of the outer lip, this is described as *prosocline*; where such an arc leans to the right it is described as *opisthocline*; where the line is perpendicular to the suture it is described as *orthocline*. These terms are used under the heading "Generic characteristics."

Turritellidae



Figures 1-14. Outer lips of type species of Turritellidae.

1. *Archimediella*; 2. *Colpospira* s.s. and *C. (Acutospira)*; 3. *Colpospira (Platycolpus)*; 4. *Colpospira (Ctenocolpus)*; 5. *Gazameda*; 6. *Haustator (Kurosoia)*; 7. *Mauricolpus*; 8. *Spirocolpus*; 9. *Turritella*; 10. *Zeacolpus* s.s.; 11. *Zeacolpus (Stiracolpus)*; 12. *Zaria*; 13. *Pareora*; 14. *Glyptozaria*.

Note: Basal sinus of *Gazameda* amended.

J. Marwick del.

3. The order of emergence of the primary spirals. Authors of several monographs in other countries in recent years have adopted various methods of defining the position of the various cords or keels and the combinations of them. The simplest procedure is that of Finlay (1930: 230), as modified by Marwick (1957: 148), naming the medial primary cord as B, and the peribasal one usually involved with the suture as D. (This cord frequently fails to appear in a number of species, or appears only on the last two or three whorls). A is the first to appear adapical to B, and C the first to appear abapical to B, that is between B. and D. The order of emergence of these primary spirals is given with the description of each genus to assist with identification.

4. Sculpture. In relying on sculpture to assist with classification, that of the primary spire whorls is usually much more reliable and less variable than that of the more mature whorls. The shape of the whorls and spiral sculpture in many species is very variable, and gerontic specimens frequently develop on parallel lines in shape and sculpture with closely allied species, which can be very misleading.

These points of determination cannot be taken in any order of precedence, but must be observed conjointly.

ORDER OF PRINTING

The type for each genus is printed first if it occurs in Australian waters, otherwise all are in alphabetical order. Fossil species are placed in order of age at the end of each genus. An index to species is at rear of the paper.

MATERIAL

Although the bulk of material for new species is shown as being held by the Australian Museum, Sydney, a number of specimens where available will be forwarded to other State Museums for reference purposes.

SIZE OF SPECIES

Sizes are shown under "Generic characteristics" according to the following table of Kotaka (1959: 59) as modified by Marwick (1971: 6).

Very large	Over 100 mm.
Large	50 - 100 mm.
Medium	20 - 50 mm.
Small	10 - 20 mm.
Very Small	Under 10 mm.

SPECIES OMITTED

The two following species formerly on record in Australia have been omitted for the reasons stated:

Turritella microscopica May, 1910. Examination of the holotype shows that this has no connection with the Turritellidae but is possibly an *Aclis*, family Aclididae.

Turritella multilirata A. Adams and Reeve, 1848. This species was recorded by Melvill and Standen (1899: 170), from dredgings by Prof. A. C. Haddon, and taken at Boydong Cays, 50 miles south of Cape York Peninsula, off the east coast of Queensland. The specimen was forwarded for inspection by the Manchester Museum, England, but proved to be *Haustator (Kurosoia) cingulifer* Sowerby.

FOSSIL SPECIES

All necessary data regarding Tertiary fossil species has been included, the Formation, Local Stage name and Epoch being cited in each case for the relative type locality. No mention has been made of distribution, as most species are recorded from so many localities, frequently showing localised variations, that a comprehensive separate paper would be required to list them all, by a palaeontologist fully conversant with the geographical and stratigraphical distribution. The description given in each case is that of specimens from the type locality only, together with photographs of suitable specimens, only two being from other than type localities.

ACKNOWLEDGEMENTS

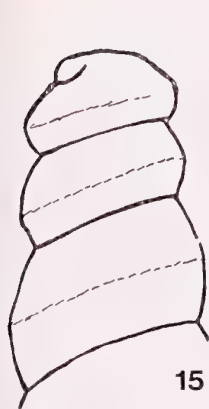
I wish to place on record my sincere thanks to the following: Dr. J. Marwick, Lower Hutt, New Zealand, for considerable assistance with

Figures 15 - 32. Protoconchs of Turritellidae.

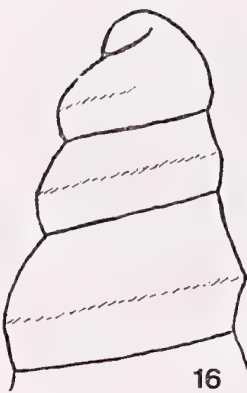
15. *Gazameda declivis* (Adams and Reeve). 31-36 metres off Masthead Is., Q.; 16, 17, 18. *Gazameda declivis* (Adams and Reeve). 58 metres E. of King Is., Bass Strait; 19. *Colpospira (Colpospira) runcinata* (Watson). 63 metres off St. Francis Is., S. Aust.; 20. *Colpospira (Ctenocolpus) australis* (Lamarck). 118 metres off Jervis Bav. N.S.W.; 21. *Colpospira (Platycolpus) quadrata* (Donald). 91 metres off Twofold Bay, N.S.W.; 22. *Spirocolpus aldingae* (Tate). Adelaide Bore, Kent Town, S. Aust.; 23. *Archimediella fastigiata* (Adams and Reeve). Roebucke Bay, W.A.; 24. *Zeacolpus (Zeacolpus) vittatus* (Hutton). Castlecliff, Wanganui, N.Z.; 25. *Zeacolpus (Stira-colpus) symmetricus* (Hutton). 185 metres off Otago Heads, N.Z.; 26. *Glyptozaria opulenta* (Hedley). 9-14 metres Twofold Bay, N.S.W.; 27. *Kimberia neptunensis* (Verco). 170 metres S. of Cape Carnot, S. Aust.; 28. *Gazameda gunnii* (Reeve). 137 metres off Broken Bay, N.S.W.; 29. *Haustator (Kurosoia) cingulifer* (Sowerby). 4 metres Keppel Bay, Q.; 30. *Haustator (Kurosoia) leeuwinensis* Garrard. 142 metres W. of Jurien Bay, W.A.; 31. *Colpospira (Acutospira) atkinsoni* (Tate and May). 146 metres off Gabo Is., Vic.; 32. *Pareora stylacris* (Tate). Blanche Point, Aldinga Bay, S. Aust.

Fig. 15 - 18, 28 X. Fig. 19 - 32, 36 X.

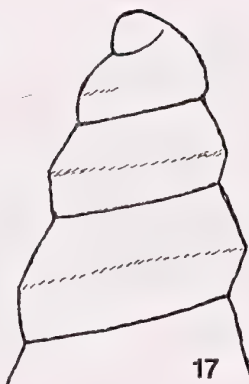
Turritellidae



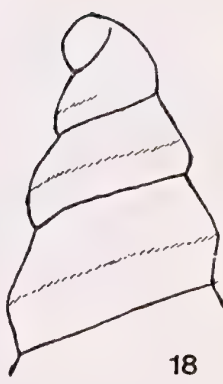
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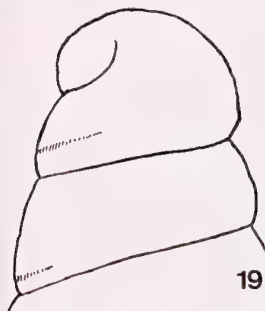
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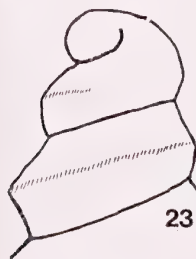
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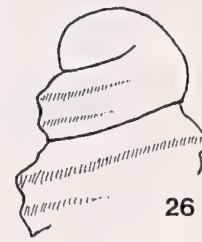
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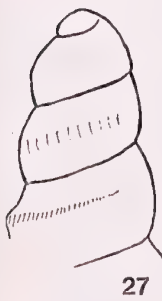
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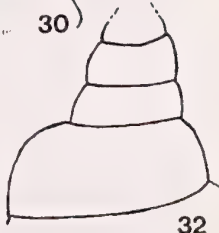
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classification; Mr. Thomas A. Darragh, Curator of Fossils, National Museum of Victoria, for considerable assistance with fossil specimens and information; Dr. Winston F. Ponder, Australian Museum, Sydney; Mr. Bruce Campbell, Queensland Museum, Brisbane; Dr. Brian Smith, National Museum of Victoria, Melbourne; Mr. Alan Dartnall, Tasmanian Museum, Hobart; Dr. Helene M. Laws, South Australian Museum, Adelaide; Dr. Barry Wilson, Western Australian Museum, Perth; to the Trustees of the Australian Museum, Sydney, and to Mr. Charles Turner of the Photography Dept., for the supply without cost of the excellent photographs; to the Staff of the Department of Molluscs, British Museum (Natural History) and to the Geology Department, University of Adelaide, for information and photographs.

TABLE OF GENERA AND SUBGENERA

Family TURRITELLIDAE Woodward, 1851

Subfamily TURRITELLINAE Woodward, 1851

<i>Archimediella</i> *(<i>Archimediella</i>)		<i>Peyrotia</i>	
	(<i>Toruloidella</i>)	<i>Sechuritella</i>	
<i>Callostracum</i>		* <i>Spirocolpus</i>	
<i>Colposigma</i>		<i>Torcula</i>	(<i>Torcula</i>)
<i>Colpospira</i>	*(<i>Colpospira</i>)		(<i>Bactrospira</i>)
	*(<i>Acutospira</i>)		(<i>Eurytorus</i>)
	*(<i>Platycolpus</i>)	<i>Torquesia</i>	(<i>Torquesia</i>)
	*(<i>Ctenocolpus</i>)		(<i>Ispharina</i>)
<i>Colpospirella</i>		<i>Tropicolpus</i>	
* <i>Gazameda</i>		* <i>Turritella</i>	
<i>Haustator</i>	(<i>Haustator</i>)	<i>Zeacolpus</i>	*(<i>Zeacolpus</i>)
	*(<i>Kurosioia</i>)		(<i>Leptocolpus</i>)
* <i>Maoricolpus</i>			*(<i>Stiracolpus</i>)
<i>Neohaustator</i>			

Subfamily PROTOMINAE Marwick, 1957

<i>Protoma</i>	(<i>Protoma</i>)
	(<i>Protomella</i>)

Subfamily PAREORINAE Finlay and Marwick, 1937

<i>Craiginia</i>	* <i>Pareora</i>	<i>Tachyrhyncus</i>
<i>Mesalia</i>	<i>Sigmesalia</i>	<i>Woodsalia</i>
<i>Motyris</i>		* <i>Zaria</i>

Subfamily TURRITELLOPSINAE Marwick, 1957

* <i>Glyptozaria</i>	* <i>Kimberia</i>	<i>Turritellopsis</i>
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ORECTOSPIRINAE Habe, 1955

Orectospira

INCERTAE SEDIS

Arcotia

* Indicates genera and subgenera dealt with in this paper.

Turritellidae

SYSTEMATIC SECTION

Subfamily TURRITELLINAE Woodward, 1851

Genus ARCHIMEDIELLA Sacco, 1895

ARCHIMEDIELLA Sacco, 1895, *Moll. Terr. Terz. Piemonte Liguria*, 19: 28. Type species by original designation *Turritella archimedis* Brongniart, 1823, non Dillwyn, 1817 = *cochlias* Bayan, 1873, Oligocene, Italy.

Generic characteristics: Medium to large, recent species brightly coloured. Whorls flatly convex to convex, spire straight-sided. Aperture sub-circular to sub-quadrate. Base flat to flatly convex. Protoconch paucispiral, asymmetric to axis of coiling, about $1\frac{1}{2}$ whorls, clear and glass-like, nucleus not usually submerged. Labial sinus orthocone, broad and very shallow (Fig. 1). Primary spirals emerge in order, B, C, A. Spiral cords medium to strong.

Archimediella dirkhartogensis sp. nov.

Pl. 26, fig. 1.

Description: PROTOCONCH paucispiral, asymmetric, $1\frac{1}{2}$ whorls, clear and glass-like, nucleus not submerged. TELEOCONCH 14 whorls, strongly convex. SUTURES deeply impressed. SCULPTURE commences with a medium spiral cord a little below centre on first whorl, followed by a second cord on next whorl midway between first cord and lower suture; a further cord follows on about fourth whorl between central cord and upper suture; a number of minor striae are formed from second whorl onwards, gradually becoming more pronounced; on holotype the central and lower main cords retain predominance, the third or posterior cord a little less so; in other specimens from sixth or seventh whorl onwards all are of about equal strength and usually total ten to twelve; between these cords are a number of very fine threads, granulated by the crossing of extremely fine and close packed growth striae. APERTURE sub-circular, columella arcuate, outer lip thin with typical sinus. BASE of shell flatly convex with fifteen or more flatly rounded striae crossed by very fine and densely packed growth striae. COLOUR white with reddish-brown axial flames showing mainly on main cords and giving shell a densely spotted appearance. OPERCULUM unavailable.

Type locality: North of Dirk Hartog Island, Shark Bay, Western Australia, 73 metres.

Dimensions: Holotype, length 30.3 mm, breadth 8.9 mm, Western Australian Museum, Reg'd. No. 834-70, together with four paratypes Reg'd. Nos. 835/6/7/8-70. Two paratypes Australian Museum, Sydney, Reg'd. No. C.77826. Six paratypes Bernice P. Bishop Museum, Honolulu, Reg'd. No. BBM 217609.

Distribution: From Shark Bay southwards, and along southern coast-line of Western Australia at least as far as Eucla.

Material: 14 specimens Australian Museum, Sydney, and 30 from Western Australian Museum, Perth, including holotype.

Discussion: This species shows the central and lowest of the three main cords as prominently on many specimens as those of *A. fastigiata* (Adams and Reeve), on other specimens they are more subdued, and on

many more they are only of equal importance with all others. However it lacks the wavy axial flames of *A. fastigiata*, which are replaced by dense spotting. The species differs from *A. infracontracta* (E. A. Smith) from the Andaman Islands in having far fewer and more pronounced striations, consequently more widely spaced, with the spotting far larger and bolder in appearance. It is strange that this species should completely overlap the apparently rather limited area occupied by *A. occidua* (Cotton and Woods), and although of the same genus the two species bear little resemblance to each other.

Archimediella fastigiata (A. Adams and Reeve, 1848)

Pl. 26, fig. 2; Pl. 30, fig. 7-8.

1848 *Turritella fastigiata* A. Adams and Reeve, *Voy. Samarang*, p. 48, pl. 12, fig. 9.

1849 *Turritella fastigiata*. Reeve, *Conch. Icon.*, 5, pl. 10, fig. 48.

1886 *Turritella fastigiata*. Tryon, *Man. Conch.*, 8: 204, pl. 63, fig. 92.

Description: PROTOCONCH paucispiral, asymmetric, $1\frac{1}{2}$ whorls, clear and glass-like, nucleus prominent. TELEOCONCH 18 to 20 whorls, contracted above, rounded below. SUTURES fairly impressed. SCULPTURE — earliest whorls with 2-3 cords, increasing to about 12 cords on later whorls, one central cord and another half-way between it and lower suture always predominant, and the outstanding feature of the sculpture. APERTURE sub-circular; columella arcuate, inner lip reflected; outer lip thin with typical sinus. BASE of shell flatly convex, 18 to 20 irregular raised striae crossed by faint growth lines. COLOUR pale violet and white with oblique brown streaks, occasionally fairly dark brown with white flames. OPERCULUM unavailable.

Type locality: "China Seas."

Dimensions: Holotype — dimensions of original painting — length 56 mm, breadth 12 mm, British Museum (Natural History) Reg'd. No. 1969270.

Distribution: At least as far east as Melville Island, Northern Territory, and south along Western Australian coast as far as Shark Bay.

Material: Numerous specimens from six State Museums.

Discussion: This species in its typical form extends from the Northern Territory along the Western Australian coast to at least as far south as Shark Bay. Apart from other differences, the larger *Turritella terebra* (Linnaeus) can at once be separated from *A. fastigiata* by the presence of a third major cord midway between the other two, which is quite consistent on all specimens examined, and gives the lower part of the whorls of *T. terebra* a somewhat bulbous appearance.

A most extraordinary complex of varieties of this species occurs round the Dampier Archipelago and islands off Onslow, Western Australia. Most specimens show a ridge with a heavier cord about the centre of each whorl, and a further similar corded ridge half-way between this and the lower suture, similar to *A. fastigiata* s.s. Other specimens have the whorls quite convex with no sign of these ridges, with 17 or 18 densely packed cords to each whorl, and all of about equal value. In other half-way specimens the ridges are present in a suppressed form. Some of these specimens with a finer sculpture than others tend to

resemble *A. infracontracta* (E. A. Smith), named from the Andaman Islands, Bay of Bengal. However none possess the dense and very fine spotting of that species. The axial flames tend to disappear entirely on most specimens, the bulk of which assume a general overall colour ranging from pale cream or light yellow to yellow-brown or medium brown.

The large paucispiral protoconch of the species of *Archimediella* strongly suggests that there is either no pelagic stage or at most a very short pelagic stage. This fact, plus the sedentary nature of the adult molluscs, indicate that it is not surprising to find distinct and greatly varied forms occurring in the above rather restricted area (Marwick, 1957: 144-5). What is somewhat inexplicable however, is that the distinct but obviously closely related *A. dirkhartogensis* Garrard should be so widely distributed from Shark Bay round the southern coastline to at least as far east as Eucla, also that *A. fastigiata* s.s. occurs right down the coast, in and amongst the Onslow "forma" to at least as far south as Shark Bay.

Archimediella maculata (Reeve, 1849)

Pl. 26, fig. 3.

1849 *Turritella maculata* Reeve, *Conch. Icon.*, 5, pl. 7, fig. 33.

1886 *Turritella maculata*. Tryon, *Man. Conch.*, 8: 202, pl. 63, fig. 83.

1909 *Turritella maculata* var. *ornata* Schepman, *Siboga Exped.*, pt. 2: 188, pl. 11, fig. 11.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ whorls, nucleus slightly submerged. TELEOCONCH about 18 whorls, flatly convex and strongly bicarinate. SUTURES slightly impressed. SCULPTURE — a heavy cord in centre and towards base of whorls, with a strong cingulum sometimes present below upper suture on last seven or eight whorls; a number of fine striae between cords, growth striae very faint. APERTURE sub-quadrate; columella arcuate, inner lip slightly recurved at base; outer lip thin and crenulated by cords, with typical sinus. BASE of shell flatly convex, some specimens with three heavy cords and several fine striae between each, others with up to 12 strong striae and 3 or 4 finer threads between each. COLOUR off-white, all striae topped with brown, brown spots on all heavy cords, and occasional dark brown axial flames. OPERCULUM unavailable.

Type locality: China Sea.

Dimensions: Holotype — Reeve's painting — length 69 mm, breadth 19 mm, British Museum (Natural History) Reg'd. No. 1969267.

Distribution: In Australia, apparently far northern coastline only.

Material: 6 specimens Australian Museum, Sydney; 3 from Queensland Museum, Brisbane; 2 from National Museum of Victoria, Melbourne.

Discussion: The occurrence of this species on the northern coastline is apparently rather sparse. Three specimens in fair condition are held by the Queensland Museum marked "Queensland," no record of exact locality. Two half-grown specimens in good condition held by National Museum of Victoria, Melbourne, marked from Port Essington, Northern Territory; these are the only specimens from Australia held by Australian Museums. As none of the above specimens were suitable for illustration, a better specimen held by the Australian Museum, Sydney, from Tarrut Bay, Saudi Arabia, has been used to give a better idea of form and colour pattern, being very similar to above two small specimens from Port Essington.

Turritellidae

Archimediella occidua (Cotton and Woods, 1935)

Pl. 26, fig. 4.

1935 *Turritella terebra occidua* Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 369, text fig. 7, p. 378.

Description: PROTOCONCH — none available, but almost certainly similar to others in the genus. TELEOCONCH 14 whorls, rounded convex, sides of spire straight. SUTURES slightly impressed. SCULPTURE of first few whorls strongly three-corded, central the strongest, and these three usually remain predominant; further sculpture of finer striae appear at intervals, some increasing in strength, some remaining fairly fine; all are crossed by numerous fine incremental striae conforming to outer lip sinus. APERTURE sub-quadrate; columella a little arcuate, inner lip reflected anteriorly; outer lip thin, crenulated by striae exteriorly, with typical sinus. BASE of shell flat with numerous fine wavy concentric threads crossed by growth lines. COLOUR light to medium brown, occasionally axially flamed with white. OPERCULUM unavailable.

Type locality: King George's Sound, Western Australia, 12-14 fathoms (22-25 metres).

Dimensions: Holotype, length 22 mm, breadth 6 mm, South Australian Museum, Adelaide, Reg'd. No. D.11439. Largest paratype examined, length 30.5 mm, breadth 7.5 mm.

Distribution: Apart from the type locality the only other record appears to be from Hopetoun, Western Australia, 35 fathoms (63 metres).

Material: Holotype and numerous paratypes, South Australian Museum. Three specimens, Australian Museum, Sydney.

Discussion: This species, although obviously closely related to *A. dirkhartogensis* Garrard, is quite distinct, growing to approximately the same size and same number of whorls, but possessing the three dominant keels throughout. It is darker and more evenly coloured and entirely lacks the conspicuous spotting. The three main keels on all whorls separate it from the biangulate whorls of *A. fastigiata* (Adams and Reeve). The species was named by Cotton and Woods as a subspecies of the much larger *Turritella terebra* (Linnaeus), but it has no connection with that genus, and is typical of the genus in which it is now placed.

Genus COLPOSPIRA Donald, 1900

Subgenus COLPOSPIRA s.s.

COLPOSPIRA Donald, 1900, *Proc. Mal. Soc. Lond.*, 4: 51. Type species by original designation *Turritella runcinata* Watson.

Subgeneric characteristics: Species range from very small and translucent to medium and solid. Whorls mostly flatly convex, some very small species a little concave. Spire mainly straight sided, some concave. Aperture usually sub-quadrate. Base convex to flatly convex. Protoconch of $1\frac{1}{2}$ to 2 whorls, asymmetric, flatly rounded to globose, clear or translucent. Labial sinus orthocline, deep and narrow. Primary spirals emerge in order C, A, B, sometimes C and A only. Spiral cords fairly fine to very strong and coarse.

Turritellidae

Colpospira (Colpospira) runcinata (Watson, 1881)

Pl. 26, fig. 5.

- 1869 *Torcula tennilirata* Dunker, *Mus. Godeff.*, Cat. 4: 77, No. 3433; *nomen nudum*.
 1874 *Murchisonia sutoris* Dunker, *Mus. Godeff.*, Cat. 5: 148, subst. name for *T. tennilirata* referred to *Zarita* on p. 212. Name validated as synonym of *C. runcinata* (Watson) by Donald, 1900, *Proc. Mal. Soc. Lond.*, 4: 50.
 1881 *Turriteila runcinata* Watson, *Jour. Linn. Soc. Lond.*, Zool., 15: 218.
 1884 *Turritella higginsii* Petterd, *J. Conch. Paris*, 4: 135.
 1883 *Turritella runcinata*. Watson, *Rep. Sci. Res. Challenger*, Zool., 25: 475, pl. 30, fig. 3.
 1900 *Colpospira runcinata*. Donald, *Proc. Mal. Soc. Lond.*, 4: 51.
 1924 *Colpospira runcinata*. Iredale, *Proc. Linn. Soc. N.S.W.*, 49: 249.
 1962 *Colpospira runcinata*. Macpherson and Gabriel, *Mar. Moll. Vict.*, p. 99.

Description: PROTOCONCH asymmetric, of two flatly globose whorls, nucleus slightly submerged, translucent. TELEOCONCH 15 whorls, all flatly convex, first five smooth. SUTURES fairly impressed. SCULPTURE after first five whorls becoming increasingly strong, consisting of heavy cords and numerous fine striae, of no set pattern, showing considerable variation. APERTURE sub-quadrate, columella arcuate; outer lip thin with typical sinus. BASE of shell flatly convex with 30 or more flat irregular spirals. COLOUR of apex yellow, next few whorls white speckled with yellow, gerontic whorls off-white. OPERCULUM black, approx. 3.5 mm diameter, heavy rounded outer edge, depressed centre, with number of very fine concentric spirals.

Type locality: Bass Strait, off East Moncoeur Island, 38-40 fathoms (69-73 metres).

Dimensions: Holotype, length 31.75 mm, breadth 10.16 mm, British Museum (Natural History) Reg'd. No. 1887.2.9.1495-7. Largest specimen examined, length 39 mm, breadth 12.5 mm.

Distribution: From central New South Wales coast to Victoria, southern Tasmania, South Australia, southern coast of Western Australia and north as far as Rottnest Island.

Material: Numerous specimens from six State Museums, including several topotypes.

Discussion: Sculpture on adult whorls varies considerably, heaviest cords usually towards base of whorls, and frequently parallels that of the closely allied *C. (A.) accisa* (Watson); the latter can easily be separated by the two sharp strong keels on every whorl.

Iredale (1924: 247) went out of his way to denigrate the whole of Watson's work. He stated (p. 249) that he had examined the holotypes of *C. runcinata* and *C. (A.) accisa* and concluded that they were identical, also that *C. cordisimei* (Watson) was a juvenile of the same species. However examination of a long series of all three species shows Watson's highly detailed descriptions to be completely accurate. This is one species where most reliance should be placed on the primary whorls for identification, in conjunction with the deep labial sinus and the protoconch. It bears a strong resemblance to the fossil species *C. conspicabilis* (Tate), and is possibly a direct descendant, but that species has flat primary whorls, also a more consistent sculpture of a heavy ridge at base of whorls with three strong cords above.

Colpospira (Colpospira) aquamarina sp. nov.

Pl. 26, fig. 6.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ flatly globose whorls, translucent white, nucleus slightly submerged. TELEOCONCH of 14 flatly convex whorls. SUTURES very slightly impressed. SCULPTURE shows a sharp cord just below centre on first two whorls, tending to fade on third whorl, after which a slight cingulum appears at top and bottom of each whorl from about fourth onwards, becoming progressively more pronounced, with three to six fine striations appearing between cingula. Subsequent development of sculpture varies considerably, whorls in some specimens becoming somewhat flattened, retaining the fine striae; whorls in other specimens become distinctly concave between the two cingula. APERTURE sub-quadratic; columella arcuate, inner lip slightly reflected; outer lip thin with typical sinus. BASE of shell flat, six or seven fine concentric striae, crossed by faint growth lines. COLOUR fawn, usually with purplish band in centre of whorls, colour showing through from inside; a row of more or less distinct white spots immediately below the sutures in some specimens, a few others showing brown and white spots alternately; first three or four teleoconch whorls glass-like, with white interior canal in shell showing through. OPERCULUM unavailable.

Type locality: East of Wooli, New South Wales, 110 metres.

Dimensions: Holotype, length 14.5 mm, breadth 3.8 mm, Australian Museum, Sydney, Reg'd. No. C.72586. Largest paratype, length 17.5 mm, breadth 5.1 mm.

Distribution: Apart from type locality, specimens have so far been obtained from 70 metres, Moreton Bay; 115-122 metres, north-east of Cape Moreton, and 36-55 metres, off Jumpin Pin Bar, all southern Queensland.

Material: Holotype and 15 paratypes, all Australian Museum.

Discussion: Some specimens, more especially those with the flattened whorls and fine striae, could be confused with immature specimens of *Gazameda tasmanica* (Reeve), but completely lack the pitting common to that species, also the distinctive *Gazameda* protoconch and wider and shallower labial sinus. This species also grows only one-third the size of *G. tasmanica*.

Colpospira (Colpospira) bundilla sp. nov.

Pl. 26, fig. 17.

Description: PROTOCONCH asymmetric, of two whorls, flatly globose. TELEOCONCH of 12 whorls, first two slightly concave, central portion of later whorls increasing in concavity, whole of spire decidedly concave. SUTURES at base of deep V-notch but very little impressed. SCULPTURE of two fairly sharp but not pronounced cords on early whorls, lower one slightly higher, with broad concave section between; space above upper cord slopes outward from suture, being either flat or a little concave; space below lower cord either flat or slightly convex; sections above and below sutures in places show vague traces of three or four faint striae; general

T. A. Garrard

appearance of whole is smooth and highly polished. APERTURE sub-quadrated; columella arcuate, inner lip strongly reflected at base, almost forming an open canal at junction with basal portion of outer lip; outer lip thin, with typical sinus between the two ridges; lower edge of outer lip curves downward in an arc to meet the pseudo-canal at junction with inner lip. BASE of shell slightly convex, with five to seven somewhat obscure concentric striae crossed by microscopic growth lines. COLOUR of most specimens a light yellow-brown in the smooth centre section, some lacking any colour and merely translucent white, a few coloured an even reddish-brown over last six or seven whorls. OPERCULUM circular, approx. 0.65 mm diameter, medium brown, shining, with seven concentric ridges, central nucleus deeply depressed, fairly thick and gelatinous in appearance under high magnification.

Type locality: North-east of Cape Moreton, southern Queensland, 114-123 metres.

Dimensions: Holotype, length 5.2 mm, breadth 1.6 mm, Australian Museum, Sydney, Reg'd. No. C.72588. Largest paratype, length 9 mm, breadth 2.4 mm.

Distribution: Apart from type locality the only other records are that from Western Australia below, and one live-taken specimen from 109 metres, east of Wooli, northern New South Wales. This latter specimen features a greatly expanded body whorl, which is also in evidence in a few of the 150 paratypes examined.

Material: Holotype and 150 paratypes, Australian Museum; four specimens from South Australian Museum, Adelaide.

Discussion: Four specimens in the South Australian Museum collection from 300 fathoms (549 metres), 120 miles west of Eucla, Western Australia, and dredged by Verco, are identical in all respects, except that one specimen, after the seventh whorl, shows a distinct nodulation of both cords at top and bottom of each whorl; the nodules are somewhat elongated and oblique, those forming the top cord being inclined to the right and those on the bottom cord to the left. The shells are opaque white, not live taken, and have no sign of the brown colour band as with the Queensland specimens. None of the Queensland specimens examined shows any sign of this nodulation. This species shows some affinity with two other new species described below and the differences are noted in the discussion following both of them. The specific name is a New South Wales Aboriginal noun-in-apposition meaning "Meeting of the waters."

Colpospira (Colpospira) cordismei (Watson, 1881)

Pl. 26, fig. 7.

1881 *Turritella cordismei* Watson, *Jour. Linn. Soc. Lond., Zool.*, 15: 224.

1886 *Turritella cordismei* Watson, *Rep. Sci. Res. Challenger, Zool.*, 25: 469, pl. 29, fig. 1.

1924 *Turritella cordismei* Iredale, *Proc. Linn. Soc. N.S.W.*, 49: 249.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ flatly convex whorls, nucleus a little submerged. TELEOCONCH 13 flatly convex whorls. SUTURES deeply impressed. SCULPTURE — first four whorls have one central cord, followed by three, sometimes four, strong evenly spaced striae, with a heavy cord at base of whorls, all crossed by numerous sinuate growth striae conforming to shape of labial sinus.

APERTURE sub-quadrate; columella arcuate, inner lip strongly reflected throughout its length; outer lip thin with typical sinus. BASE of shell flatly convex with up to 12 faint flattened striae crossed by numerous growth lines. COLOUR — central New South Wales coast specimens are cream in colour with alternate brown and white spots on all striae, indefinite whitish patches on most whorls; more southerly specimens are mainly overall chestnut with little or no spotting. OPERCULUM light brown, concave with upturned edge, multispiral with central nucleus.

Type locality: Bass Strait, off East Moncoeur Island, 38-40 fathoms (69-73 metres).

Dimensions: Holotype, length 11.17 mm, breadth 3.3 mm, British Museum (Natural History) Reg'd. No. 1887.2.9.1479-82.

Distribution: From New South Wales central north coast southwards to Victoria and Tasmania.

Material: Numerous specimens from Australian Museum, fair number from National Museum of Victoria.

Discussion: Regarded for many years as a synonym of *C. runcinata* (Watson) but is quite distinct and only one-third the size. Several

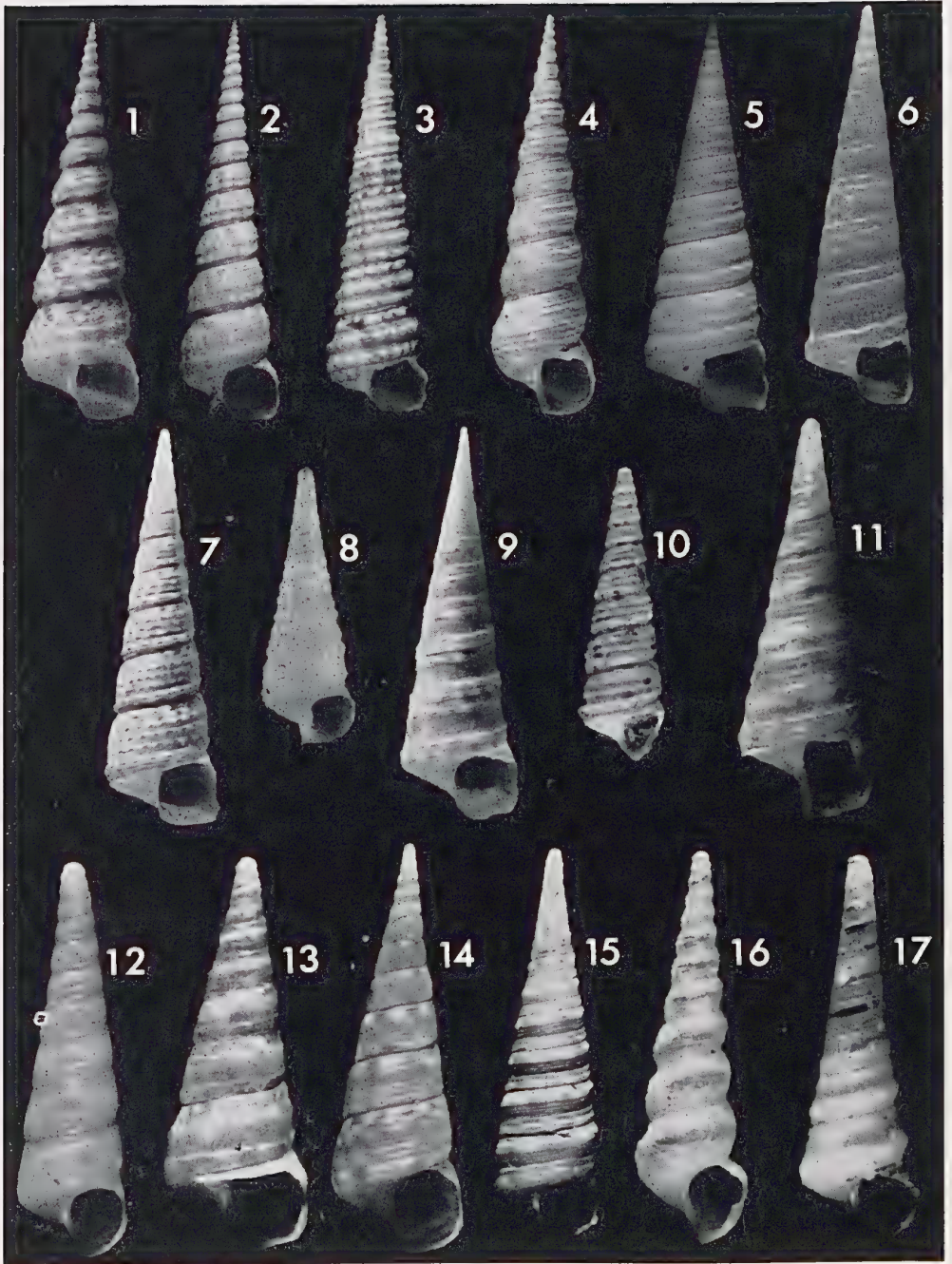
PLATE 26

1. *Archimediella dirkhartogensis* Garrard. North of Dirk Hartog Island, Shark Bay, Western Australia, 73 metres. Holotype, X 2.1. W.A.M. No. 834-70.
2. *Archimediella fastigiata* (Adams and Reeve). Off Melville Island, Northern Territory, 45 metres. Figured specimen, X 1.2. A.M. No. C77332.
3. *Archimediella maculata* (Reeve). Tarrut Bay, Saudi Arabia. Figured specimen, X 1.3. A.M. No. C77374.
4. *Archimediella occidua* (Cotton and Woods). King George Sound, Western Australia. Figured specimen (Topotype), X 2.1. A.M. No. C77333.
5. *Colpospira (Colpospira) runcinata* (Watson). Off Neptune Island, South Australia, 73 metres. Figured specimen, X 1.7. A.M. No. C19306.
6. *Colpospira (Colpospira) aquamarina* Garrard. Off Woolli, New South Wales, 110 metres. Holotype, X 4.4. A.M. No. C72586.
7. *Colpospira (Colpospira) cordisimei* (Watson). Off Port Hacking, New South Wales, 82 metres. Figured specimen, X 3.5. A.M. No. C77329.
8. *Colpospira (Colpospira) deliciosa* (Watson). Off Raine Island, Torres Strait, 283 metres. Holotype, X 5. B.M.N.H. No. 87. 2. 9. 1488-91.
9. *Colpospira (Colpospira) decoramen* (Iredale). East of Sydney, New South Wales, 457 metres. Figured specimen, X 2.7. A.M. No. C24433.
10. *Colpospira (Colpospira) joannae* Hedley. East of Sydney, New South Wales, 750 metres. Holotype, X 7.2. B.M.N.H. No. 89.10.26.89.
11. *Colpospira (Colpospira) indigena* Garrard. North-east of Cape Moreton, southern Queensland, 114-123 metres. Holotype, X 9.1. A.M. No. C72590.
12. *Colpospira (Colpospira) mediolevis* (Verco). South-west of Cape Adieu, South Australia, 79 metres. Figured specimen, X 11.3. A.M. No. C77331.
13. *Colpospira (Colpospira) moretonensis* Garrard. Off Jumpin Pin Bar, southern Queensland, 36-54 metres. Holotype, X 10.9. A.M. No. C72589.
14. *Colpospira (Colpospira) sinuata* (Reeve). Disaster Bay, New South Wales, 27 metres. Figured specimen, X 4. A.M. No. C77330.
15. *Colpospira (Colpospira) sophiae* (Brazier). North-east of Cape Moreton, southern Queensland, 114-123 metres. Figured specimen, X 7.2. A.M. No. C77381.
16. *Colpospira (Colpospira) translucida* Garrard. South-west of Eucla, Western Australia, 79-140 metres. Holotype, X 10.9. A.M. No. C72587.
17. *Colpospira (Colpospira) bundilla* Garrard. North-east of Cape Moreton, Southern Queensland, 114-123 metres. Holotype, X 12.1. A.M. No. C72588.

Abbreviations used for various Museums are as under:

- A.M. Australian Museum, Sydney, New South Wales.
 B.M.N.H. British Museum (Natural History), London.
 N.M.V. National Museum of Victoria, Melbourne.
 S.A.M. South Australian Museum, Adelaide.
 T.M. Tate Museum, Geology Dept., University of Adelaide, South Australia.
 W.A.M. Western Australian Museum, Perth.

Photographs: All photographs are by Mr. Charles V. Turner, Photography Dept., Australian Museum, Sydney, with the following exceptions: Pl. 26, fig. 8 and 10 — British Museum (Natural History), London; Pl. 27, fig. 2 — T. A. Darragh and K. N. Bell, National Museum of Victoria; Pl. 30, fig. 7-9 — Commercial photographer.



specimens have been checked with the holotype in the British Museum (Natural History). It changes considerably in appearance from north to south in its range. The more southerly specimens nearer the type locality, in addition to the change in colour as above, also tend to have decidedly heavier striations. The species is quite distinct and does not appear to have any close relatives.

Colpospira (Colpospira) decoramen (Iredale, 1936)

Pl. 26, fig. 9.

1936 *Gazameda decoramen* Iredale, *Rec. Aust. Mus.*, 10: 292, pl. 21, fig. 20.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ flatly globose whorls, nucleus a little submerged, translucent. TELEOCONCH up to 14 whorls, first four or five a little convex, balance flat with concave centre. SUTURES moderately impressed. SCULPTURE — first four or five convex whorls are almost smooth; sculpture commences gradually with a medium sharp cord above suture about fifth or sixth whorl, a further strong sharp cord below upper suture one or two whorls later; cord above lower suture frequently becomes strongly bifurcate on gerontic whorls; four to ten fine striae in concave section between cords, often up to five more between lower cord and adjoining suture; fine to coarse growth striae cross cords and threads in an irregular manner, conforming to deep labial sinus. APERTURE sub-quadrate; columella arcuate, inner lip strongly reflected on to body-whorl; outer lip thin with deep narrow central sinus. BASE of shell flatly convex with numerous irregular concentric striae, crossed by very fine growth lines. COLOUR — apex and primary whorls white, balance mottled brown and white with somewhat curved vertical flames; red and white alternate spots on both ridges. OPERCULUM circular, black-brown, central nucleus, concave, with about 12 concentric overlapping lines of growth.

Type locality: Off Sydney, New South Wales, 65-70 fathoms (118-128 metres).

Dimensions: Holotype, length 18 mm, breadth 6.5 mm, Australian Museum, Reg'd. No. C.60635.

Distribution: Eastern Victoria through New South Wales to southern Queensland, in depths from 73 to 549 metres.

Material: Large quantity of specimens from a number of localities, Australian Museum.

Discussion: Examination of many specimens from a number of localities shows this species to be more variable in sculpture than expected from examination of those near the type locality. Some from off Montague Island, southern New South Wales, are considerably flatter and smoother, the two strong ridges giving way to one small one at base of whorls, the sub-sutural ridge being almost non-existent, and intermediate striae are microscopic. Some specimens from off Botany Bay, whilst conforming generally, have two very strong striations in centre of each whorl, finely decussated by growth lines. This feature is even more pronounced and fairly constant in numerous specimens from deep water north-east of Cape Moreton, southern Queensland. Specimens vary in length from that of the holotype, 18 mm, up to 24 mm, whilst one from 549 metres east of Sydney measures 30.5 mm. This species has no close relatives and is

Turritellidae

easily distinguished by the extremely fine apex, followed by the rapidly expanding later whorls, which gives the spire a greater concavity than any other species in the genus.

Colpospira (Colpospira) deliciosa (Watson, 1881)

Pl. 26, fig. 8.

1881 *Turritella deliciosa* Watson, *Jour. Linn. Soc. Lond., Zool.*, 15: 226.1886 *Turritella deliciosa*, Watson, *Rep. Sci. Res. Challenger, Zool.*, 25: 471, pl. 29, fig. 3.

Description: PROTOCONCH asymmetric, of two flatly rounded whorls, nucleus not depressed, slightly tumid, hyaline. TELEOCONCH of 12 whorls, flat in appearance, but contracted above, below and between the two main cords. SUTURES fine and inconspicuous but impressed. SCULPTURE — two strong, broad, rounded cords; area between cords a little concave with a somewhat smaller striation in centre of depression; above each cord a minute thread. APERTURE rectangularly triangular, right-angle being at base of columella; columella straight, with slight swelling towards upper end, reflected as a thin glaze on to body-whorl; outer lip thin, slightly crenulate, with typical sinus; basal lip patulous and prominent, meeting columella almost at right-angles, where it forms a slight narrow canal. COLOUR porcellanous glossy white. OPERCULUM unavailable.

Type locality: Off Raine Island, Torres Strait, 155 fathoms (283 metres).

Dimensions: Holotype, length 8.88 mm, breadth 2.14 mm, British Museum (Natural History), Reg'd. No. 87.2.9.1488-91.

Distribution: At present only recorded from the type locality.

Material: Photographs of 3 specimens supplied by British Museum (Natural History).

Discussion: Reliance has had to be placed on Watson's drawing of the outer lip for inclusion of this species in the genus *Colpospira*, although the possibility that its affinities lie with either of the subgenera (*Kurosoioia*) or (*Platycolpus*) cannot be dismissed. Only a later examination of both labial and basal sinuses of the holotype coupled with other features will prove this point. The photograph illustrated, by courtesy of the British Museum (Natural History), shows the holotype very clearly, and unfortunately a search through recent extensive dredgings from the Arafura Sea in somewhat similar depths to that in which the holotype and paratypes were found, has failed to produce further specimens. The species is quite distinct and has no near relatives in Australian waters.

Colpospira (Colpospira) indigena sp. nov.

Pl. 26, fig. 11.

Description: Protoconch paucispiral, asymmetric, clear and glass-like, of 1½ flatly globose whorls, nucleus slightly submerged. TELEOCONCH 12 whorls, flatly concave, sides of spire straight. SUTURES a little impressed at base of deep V-notch. SCULPTURE commences as a slight cord a little below centre of first main whorl, gradually "moving" abapically until by sixth or seventh whorl it is one-fourth of whorl height

above lower suture; a second cord commences on second whorl one-third of the height of whorl below the upper suture, and becomes of equal prominence with the first cord on the next whorl; space between upper suture and upper cord slightly concave, sometimes with one or two faint striae; space between cords smooth and very concave; lower cord bifurcate from about centre of shell to body-whorl, and space below this and lower suture usually flat; a strong liration is present below the bifurcate cord on the body-whorl. APERTURE sub-quadrate; columella arcuate, inner lip a little reflected; outer lip thin with sinus typical of genus. BASE of shell flat with four or five medium but depressed lirae, crossed by numerous growth lines. COLOUR off-white or cream, translucent, with interior spiral canal clearly visible in good specimens. OPERCULUM unavailable.

Type locality: North-east of Cape Moreton, southern Queensland, 114-123 metres.

Dimensions: Holotype, length 6.9 mm, breadth 2.1 mm, Australian Museum, Sydney, Reg'd. No. C.72590. Largest paratype, length 8.6 mm, breadth 2.7 mm.

Distribution: In addition to type locality, other records are from 70 metres two miles north-east of Gillet Cay, and 54 metres off One Tree Island, both southern Queensland.

Material: Holotype and six paratypes, all Australian Museum, Sydney.

Discussion: This species differs from *C. bundilla* Garrard in being a little wider for its length, also larger and a little more heavily built. It is one colour only and lacks the central colour band, the ridges are bolder, the lower one bifurcate, which does not occur in *C. bundilla*. The differences are somewhat slight but distinct and consistent.

Colpospira (Colpospira) joannae Hedley, 1923

Pl. 26, fig. 10.

1900 *Turritella (Colpospira) crenulata* Donald, *Proc. Mal. Soc. Lond.*, 4: 52, pl. 5, figs. 2a, b.

1912 *Turritella reevei* Cossmann, *Ess. Pal. Comp.*, 9: 119, (non Dautzenberg and Fischer, 1907).

1923 *Colpospira joannae* Hedley, *Proc. Linn. Soc. N.S.W.*, 48: 311. (New name for *T. crenulata* Donald, 1900, non Nyst, 1843).

Description: PROTOCONCH asymmetric, of about two flatly globose whorls, nucleus a little submerged. TELEOCONCH ten whorls, quadrate in form, flattened, spire straight-sided. SUTURES incised within a pronounced V-notch. SCULPTURE — first whorl with strong crenulate cord at base, followed by a second at top of fourth whorl, and a third crenulate cord between these on next whorl, all three increasing in strength, the third or anterior cord being the strongest; a few sinuate growth lines cross the cords at intervals. APERTURE imperfectly known, appears to be somewhat triangular in shape; columella arcuate, inner lip reflected on to body-whorl; outer lip with typical sinus. COLOUR creamy-white. BASE of shell almost flat with numerous fine concentric threads. OPERCULUM unavailable.

Type locality: Off Sydney, New South Wales, 410 fathoms (750 metres).

Dimensions: Holotype, length 6.5 mm, breadth 2 mm, British Museum (Natural History), Reg'd. No. 89.10.26.89.

Turritellidae

Distribution: The holotype is the only known specimen.

Material: Photograph supplied by courtesy of the British Museum (Natural History).

Discussion: The description given by Donald states that there are four keels on each whorl, three uppermost strongly and lowest but slightly crenulate. However the two excellent enlarged photographs of the holotype received show no sign of a fourth keel except at the base of the body-whorl. The specimen came from the disputed "Challenger" station 164B in 410 fathoms east of Sydney, New South Wales, and has been shown as a doubtful record ever since. However the presence of the deep labial sinus described by the author leaves little doubt that the locality is genuine, such a sinus being quite unknown amongst Atlantic species which were allegedly mixed with those from the above station. None of the other minute deep-water Australian forms approach at all closely to this species.

Colpospira (Colpospira) mediolevis (Verco, 1910)

Pl. 26, fig. 12.

1910 *Turritella mediolevis* Verco, *Trans. Roy. Soc. S. Aust.*, 34: 121, pl. 30, figs. 5, 6.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ flatly convex whorls, nucleus a little submerged. TELEOCONCH of nine flattish whorls becoming a little more convex with age. SUTURES well impressed within a prominent V-notch. SCULPTURE commences on third or fourth whorl, of 2 or 3 weak flatly rounded threads at top and bottom of each whorl, central area usually smooth. APERTURE sub-quadrate; columella arcuate, inner lip strongly reflected on to body-whorl; outer lip thin with typical sinus. BASE of shell convex with up to eight flat irregular concentric striae crossed by strong growth lines. COLOUR translucent creamy-white, fawn round sutures, also on base and columella. OPERCULUM unavailable.

Type locality: Cape Borda, South Australia, 62 fathoms (112 metres).

Dimensions: Holotype, length 5.2 mm, breadth 1.5 mm, South Australian Museum, Adelaide, Reg'd. No. D.13430.

Distribution: South Australia and southern Western Australia generally, in depths from 63 to 183 metres.

Material: Holotype and several paratypes, South Australian Museum; co-type and several others Australian Museum; several specimens National Museum of Victoria.

Discussion: In this species, as in *C. sophiae* (Brazier), the labial sinus tends to become deeper and narrower with age, until in many cases it corresponds with that of the genus *Spirocolpus*, however the basal sinus remains constant. The primary spiral threads are very vague and indefinite, but the protoconch and general shape of the early whorls are very similar to immature specimens of the much larger *C. runcinata* (Watson), the type for the genus. If studied carefully under medium magnification it would not be possible to confuse this minute species with any other, and it does not appear to have any close relatives.

Colpospira (Colpospira) moretonensis sp. nov.

Pl. 26, fig. 13.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ glass-like whorls, flatly globose, nucleus partly submerged. TELECONCH of at least 8 whorls, flatly convex, spire straight sided. SUTURES lightly impressed. SCULPTURE commences on first whorl with a decidedly sharp cord towards the base, which becomes depressed on second or third whorl, thereafter remaining as a slight shouldered ledge, occupying one-fourth of each whorl immediately above the lower suture and sloping convexly towards it; usually on third whorl a further slight cord appears from one-fourth to one-third of whorl's depth below upper suture, becoming gradually a little sharper and more prominent, by about the fifth whorl the space between these cords becomes a little concave, a little more so at the base than above; apart from the two cords and a single fine striation which may appear in the centre of the lower flattened cord in some specimens, the whorls are devoid of spiral striae; fine closely packed sinuous axial striations follow the lines of the labial sinus. APERTURE sub-quadrate; columella arcuate, inner lip strongly reflected at base; outer lip thin with deep and narrow medial sinus, typical of genus. BASE of shell flatly convex with five or six flattish but prominent striae crossed by densely packed lines of growth. COLOUR translucent light cream to amber, with yellowish interior spiral canal clearly visible in good specimens. OPERCULUM unavailable.

Type locality: Off Jumpin Pin Bar, southern Queensland, 36-54 metres.

Dimensions: Holotype, length 5.8 mm, breadth 2 mm, Australian Museum, Sydney, Reg'd. No. C.72589. Largest paratype, length 6.6 mm, breadth 2.1 mm.

Distribution: Apart from type locality, other records are 73 metres, off Moreton Bay, and 114-123 metres, north-east of Cape Moreton, both southern Queensland.

Material: Holotype and 35 paratypes, all Australian Museum, Sydney.

Discussion: This species differs from *C. aquamarina* Garrard chiefly in its somewhat similar but more depressed protoconch, the lack of transverse striations, and the concave central section of each whorl. From *C. bundilla* Garrard it may be separated by its straight and not concave spire, the lack of contrasting colour band in the central concave section of each whorl, and the greater convexity of the whorls. The ratio of width to length and the depressed protoconch in this species is similar to *C. sinuata* (Reeve), but it is distinguished by the lack of transverse striae, the concave central section of each whorl, and the much smaller size.

Colpospira (Colpospira) sinuata (Reeve, 1849)

Pl. 26, fig. 14.

1849 *Turritella sinuata* Reeve, *Conch. Icon.*, 5, pl. 11, fig. 62.

1867 *Turritella sinuata*. Angas, *Proc. Zool. Soc. Lond.*, p. 210, sp. 151.

1886 *Turritella sinuata*. Tryon, *Man. Conch.*, 8: 200, pl. 61, fig. 60.

1924 *Colpospira sinuata*. Iredale, *Proc. Linn. Soc. N.S.W.*, 49: 249.

1962 *Colpospira sinuata*. Macpherson and Gabriel, *Mar. Moll. Vict.*, p. 99.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ flatly globose whorls, nucleus a little submerged. TELECONCH 12 flatly

Turritellidae

convex whorls. SUTURES deeply impressed. SCULPTURE — first four whorls almost smooth; up to 20 flatly compressed threads commence imperceptibly after fourth whorl, variable in size and importance and never strong, crossed by numerous, close-packed growth lines conforming to shape of labial sinus. APERTURE sub-quadrate; columella straight, inner lip very little reflected; outer lip thin with typical sinus. BASE of shell flatly convex, with numerous concentric striae crossed by faint growth lines. COLOUR of apex white, main whorls and base off-white suffused with vertical, faint fawn patches; alternate brown and white spots below sutures. OPERCULUM dark brown, circular, consisting of numerous spiral layers of extremely thin and ragged-edged horny material, rising to a central light-brown solid nucleus, with small central depression.

Type locality: Port Jackson, New South Wales.

Dimensions: Holotype, Reeve's painting, length and breadth are out of proportion and exact measurements are unknown. Size of an average mature specimen is, length 17 mm, breadth 6 mm. Holotype deposited with British Museum (Natural History), Reg'd. No. 1969268.

Distribution: Southern Queensland, throughout New South Wales to Victoria.

Material: Numerous specimens from six State Museums.

Discussion: This species remains constant in its main characters throughout its range, and little variation takes place in its adult length of about 17 mm. The row of red and white spots below the sutures serves as a good guide to its identity. For some reason it is frequently confused with *C. (Platycolpus) quadrata* (Donald), but the deep clean-cut V-notch at the sutures of that species together with its concave whorls sets it apart without difficulty. Immature specimens of *C. runcinata* (Watson) resemble this species to a certain extent, but the yellow apex of *C. runcinata* followed by yellow-spotted white whorls readily set it apart.

Colpospira (Colpospira) sophiae (Brazier, 1883)

Pl. 26, fig. 15.

1878 *Turritella incisa* Tenison-Woods, *Proc. Linn. Soc. N.S.W.* (1877), 2: 262.

1883 *Turritella sophiae* Brazier, *Proc. Linn. Soc. N.S.W.*, 8: 227. (New name for *T. incisa* Tenison-Woods, non Reeve, 1849).

1903 *Turritella sophiae*. Hedley, *Mem. Aust. Mus.*, 4: 348.

1925 *Turritella sophiae*. Iredale, *Rec. Aust. Mus.*, 14: 267.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ clear glass-like whorls, flatly globose, nucleus a little submerged. TELEOCONCH 13 whorls, first four or five slightly convex, rest flat and a little shouldered. SUTURES deeply impressed. SCULPTURE — first three or four whorls smooth; a sharp cord commences on fourth or fifth whorl below the suture, and another at base of whorl, which usually bifurcates; three or four strong striations in flat space between cords, all crossed by occasional microscopic sinuate growth lines. APERTURE sub-quadrate; columella slightly arcuate, inner lip strongly recurved on to body-whorl; outer lip thin with typical sinus. BASE of shell convex with seven or eight strong flat lirae, flat spaces between, and crossed by fine growth lines. COLOUR — apex and primary whorls translucent white, balance

cream to chestnut, somewhat translucent, large irregular red-brown patches on upper ridge. OPERCULUM circular, 0.8 mm diameter, reddish-brown, flat, six fine concentric ridges, central nucleus; inner side concave, five broadly rounded concentric ridges, small round raised central nucleus, the whole covered by a thick transparent gelatinous coating.

Type locality: "Off Sydney Heads."

Dimensions: Holotype, length 11 mm, breadth 3 mm, Australian Museum, Sydney, Reg'd. No. C.2470.

Distribution: 76-154 metres, east of Port Jackson, New South Wales, and 114-124 metres, north-east of Cape Moreton, southern Queensland, are the only localities on record.

Material: Holotype and 10 topotypes, also 150 specimens from the Queensland locality, all Australian Museum, Sydney.

Discussion: Iredale (1925: 267) stated: "The type of this species, preserved in the Australian Museum, has been carefully examined and proves to be a young specimen of *T. sinuata* Reeve" This statement is extraordinary, as the two species do not resemble each other in any way, apart from a vague similarity in colour pattern. Compared with *C. sinuata*, this species is only half the length and width, the protoconch is decidedly smaller, the spire is a little concave and not straight, and the transverse striae are more pronounced. The holotype was apparently the only specimen held by any Australian museum from 1878 until 1962, when several more specimens were obtained from the type locality, later followed by numerous specimens from off Cape Moreton, southern Queensland.

Colpospira (Colpospira) translucida sp. nov.

Pl. 26, fig. 16.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ flatly globose whorls, nucleus slightly submerged, clear and transparent. TELECONCH of ten whorls, some flatly convex to commence, increasing in convexity until quite globose, others with whorls quite convex from commencement. SUTURES well impressed. SCULPTURE — base of primary whorls slopes in sharply to suture, upper part of whorls consists of a slightly shouldered and somewhat flattened cord; slight grooves appear on third or fourth whorl, leaving central one-third of each whorl as a convexly flattened clear space; in most cases a strong broad flatly-rounded cord appears in the central space at about fourth or fifth whorl; cords above and below this cord may also increase in prominence, some specimens having the appearance of possessing three fairly prominent cords in centre of each whorl; striations vary considerably, some specimens with only five of unequal strength on penultimate whorl, others with up to 14. APERTURE sub-circular; columella arcuate, inner lip reflected at base; outer lip thin with deep and narrow medial sinus, typical of genus. BASE of shell convex with five or six flattened but clearly visible concentric striations, crossed by densely packed growth lines. COLOUR slightly translucent white or clear and glass-like. OPERCULUM unavailable.

Type locality: South-west of Eucla, Western Australia, 79-140 metres.

Turritellidae

Dimensions: Holotype, length 5.8 mm, breadth 1.9 mm, Australian Museum, Sydney, Reg'd. No. C.72587.

Distribution: The only other record apart from the type locality is 183 metres, 40 miles south of Cape Wiles, South Australia.

Material: Holotype and 20 paratypes from above localities, all Australian Museum, Sydney.

Discussion: As with other species in the genus *Colpospira*, gerontic whorls in this species tend to develop traces of the labial sinus conforming to *Spirocolpus*, and reliance must be placed on traces in the earlier whorls and the basal sinus, which remain constant. The main differences between this species and *C. mediolevis* (Verco), are the consistently clear and glass-like appearance as opposed to the opaque cream coloured whorls of *C. mediolevis* with the yellow-brown band beneath the sutures. The whorls on this new species are decidedly more convex, with the sutures consequently deeper, and the spirals are more prominent. Twenty specimens have been examined from the two localities and nothing resembling an intergrade with *C. mediolevis* has been seen, the two species being quite distinct.

Colpospira (Colpospira) wollumbi sp. nov.

Pl. 27, fig. 1.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ flatly globose whorls, glassy, nucleus not submerged. TELEOCONCH of nine whorls, convex throughout. SUTURES well impressed. SCULPTURE of four prominent cords, centre two usually a little more pronounced, sometimes the lowest two; several striations tend to appear between the cords in an irregular manner. APERTURE sub-circular; columella slightly arcuate, inner lip reflected; outer lip with deep and narrow medial sinus typical of the genus, and crenulated by cords on body-whorl. BASE of shell convex with five to seven fairly strong striations crossed by numerous fine growth lines. COLOUR, when in good condition, is translucent pure white or chestnut, mostly off-white with chestnut band below sutures; a similar coloured patch on centre of base. OPERCULUM circular, approx. .3 mm, thin, flat, translucent light brown, depressed central nucleus and five irregular ill-defined concentric ridges.

Type locality: East of Port Jackson, New South Wales, 77-154 metres.

Dimensions: Holotype, length 5.1 mm, breadth 1.6 mm, Australian Museum, Sydney, Reg'd. No. C.72585.

Distribution: From north of Cape Moreton, southern Queensland, through New South Wales, Tasmania, Victoria, South Australia to at least as far as Wilson Inlet, Western Australia, in depths from as little as 9 metres down to 237 metres.

Material: Holotype and large quantity of specimens from six State Museums.

Discussion: This is the species shown by May in his "*Illustrated Index of Tasmanian Shells*," 1923 (Pl. 28, fig. 10, *Stiracolpus smithianus* Donald), apparently due to the poor, or transposed, drawing of that species at pl. 5, fig. 3, *Proc. Mal. Soc. Lond.*, 1900. The species is very

widespread, occurring in six States as above, and probably in large quantities in moderately deep water. *C. (Acutospira) smithiana* (Donald) can be confused with this small species unless studied under magnification, but the four flatly rounded cords on this species commence almost simultaneously, whereas *C. (A.) Smithiana* has sharp keels commencing on successive whorls. The specific name is a New South Wales Aboriginal noun-in-apposition meaning "Meeting of the Waters."

FOSSIL SPECIES

Colpospira (Colpospira) tristira (Tate, 1885)

Pl. 27, fig. 2.

1885 *Turritella tristira* Tate, *Pap. Proc. R. Soc. Tas.*, (1884): 227.1893 *Turritella tristira*. Tate, *Trans. R. Soc. S. Aust.*, 17: 338, pl. 8, fig. 8; pl. 9, fig. 7.1935 *Turritella tristira*. Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 380.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ globose whorls, nucleus a little submerged. TELEOCONCH 17 whorls, first four or five flatly convex, next three or four medially concave, mature whorls again a little convex, sides of spire slightly concave. SUTURES a clear fine line, slightly impressed. SCULPTURE — a slight cord appears towards the base of the whorl on the third whorl, followed by a second cord on about seventh whorl, centrally situated, and a further cord towards top of ninth whorl; all develop into medium keels right to the body-whorl; microscopic striations commence about ninth whorl above, below, and between keels; incremental striae difficult to detect until about eleventh whorl; a sharp keel appears on acutely angular periphery of body-whorl. APERTURE sub-quadrate; columella arcuate; inner lip reflected anteriorly; outer lip thin, crenulated exteriorly by keels, with typical sinus. BASE of shell flat with numerous fine concentric striae crossed by very fine densely packed growth lines.

Type locality: Fossil Bluff, Table Cape, near Wynyard, Tasmania. Table Cape Group: Janjukian/Longfordian: Upper Oligocene/Lower Miocene.

Dimensions: Holotype, length originally 46 mm, now 41.5 mm due to breakage, breadth 12 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T.1419 B.

Material: 24 specimens, Australian Museum, Sydney, from Maringa Creek, near Lakes Entrance, Victoria. Holotype is only known specimen from type locality.

Discussion: See notes by Tate under *C. (C.) conspicabilis* (Tate). The sculpture on that species never appears to have developed on the same lines as *C. (C.) tristira*, with its three strong keels throughout most of the length of the shell, and there is no doubt that it is a distinct species. The species bearing the closest resemblance to *C. (C.) tristira* amongst recent species is *C. (Acutospira) accisa* (Watson), which also has three sharp strong keels throughout most of the length of the shell, but whether *C. (C.) tristira* is directly ancestral is a matter of conjecture.

This species is extremely rare at the type locality, the holotype apparently being unique. However this has been examined and the matrix present is not inconsistent with that from the upper beds at Fossil Bluff,

Turritellidae

Table Cape, i.e. the Fossil Bluff Sandstone (T. A. Darragh, pers. comm.). As further proof of the validity of the type locality being in N.W. Tasmania, five specimens agreeing well with the holotype were found near Burnie, 15 miles east of Table Cape, in 1970 by Darragh. One specimen forwarded for examination has a finely gemmate central cord.

Gippsland specimens differ from the holotype mainly by the late appearance of the central cord, usually on the tenth to twelfth whorl; this seldom becomes as prominent as the other two cords until the last two or three whorls. The spaces between the cords, also between the upper and lower cords and the adjacent sutures, also vary in width compared with the Tasmanian specimens.

Colpospira (Colpospira) calcaria sp. nov.

Pl. 27, fig. 3.

Description: PROTOCONCH asymmetric, of two flatly convex smooth whorls, nucleus free or very slightly submerged. TELEOCONCH 14 whorls, first four smooth and convex, balance flat and strongly striated; spire noticeably concave. SUTURES finely incised. SCULPTURE — an indefinite sub-central swelling on first three whorls; about fourth whorl a rounded spiral appears towards base, closely followed by others at top and centre; one to three minor cords appear irregularly later but first three predominate, either centre or lowest cord the stronger; growth striae fine and difficult to detect until last two or three whorls; whole shell smooth and polished. APERTURE sub-quadrate; columella arcuate, inner lip a little reflected at base; outer lip thin, crenulated by cords exteriorly, with deep and narrow medial sinus, typical of the genus. BASE of shell flat, with peripheral ridge and five flatly rounded concentric cords crossed by fine and densely packed growth striae.

Type locality: Blue Clays at Fossil Beach, Balcombe Bay, Mornington Peninsula, Victoria; Grid Ref. Cranbourne 072845. Balcombe Clay: Balcombian; Middle Miocene.

Dimensions: Holotype, length 7.9 mm, breadth 1.9 mm, National Museum of Victoria, Melbourne, Reg'd. No. P.27458.

Material: 35 paratypes, Australian Museum, Sydney, from type locality.

Discussion: The protoconch, primary whorls and concave spire of this very small species bear a slight resemblance to *C. (C.) platyspira*, but the keels of this new species are decidedly heavier and it grows to only half the length. It is quite common at the type locality, and also occurs in the cliff-face south of Manyung Rocks a little further north (Bairnsdalian Stage). The closest recent species as far as general shape and sculpture are concerned would be *C. decoramen* (Iredale), which is decidedly larger, but whether this new species is directly ancestral to *C. decoramen* is a matter of conjecture.

Colpospira (Colpospira) platyspira (Tenison-Woods, 1879)

Pl. 27, fig. 4.

- 1879 *Turritella platyspira* Tenison-Woods, *Proc. Linn. Soc. N.S.W.*, 3: 234, pl. 20, fig. 13.
 1893 *Turritella platyspira*. Tate, *Trans. R. Soc. S. Aust.*, 17: 341, pl. 8, fig. 9.
 1941 *Colpospira platyspira*. Ludbrook, *Trans. R. Soc. S. Aust.*, 65: 100.

Description: PROTOCONCH asymmetric, of two smooth inflated whorls, nucleus not submerged. TELEOCONCH 15 whorls, first five or so smooth and convex, followed by several whorls usually flat, last three or four again convex. SUTURES vary from lightly impressed to decidedly incised. SCULPTURE usually of three suppressed cords, evenly spaced between sutures, obsolete in some specimens, space between anterior and medial cords concave; faint threads usually present in interstices; incremental striae deeply flexuose but barely visible. APERTURE sub-quadrate; columella slightly arcuate, inner lip a little reflected at base; outer lip thin with typical sinus. BASE of shell flat with strong peripheral ridge, four or five medium spiral striations crossed by extremely fine growth lines.

Type locality: Muddy Creek, west of Hamilton, Victoria. Muddy Creek formation: Balcombian: Middle Miocene.

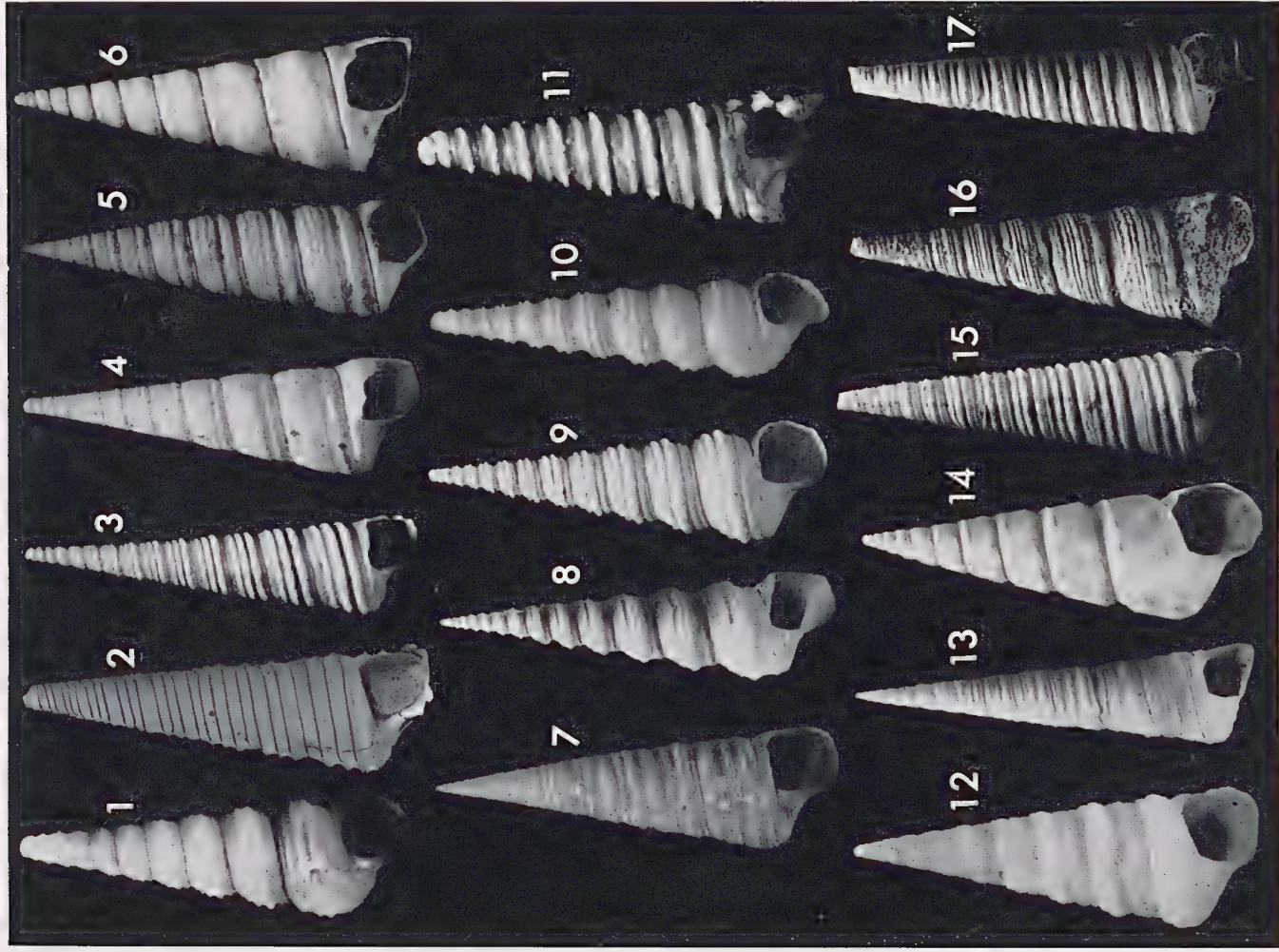
Dimensions: Holotype, length 13 mm, breadth 3.75 mm, Australian Museum, Sydney, Reg'd. No. F.1781.

Material: Six topotypes, National Museum of Victoria, Melbourne; two topotypes, Australian Museum, Sydney.

Discussion: The recent *C. aquamarina* Garrard bears a strong general resemblance to this species, however the protoconch of *C. aquamarina* whilst almost identical, is decidedly larger. It also has two medium cingula almost adjoining the sutures as opposed to the three evenly spaced striae of *C. platyspira*, and more even and evenly spaced striations.

PLATE 27

1. *Colpospira (Colpospira) wollumbi* Garrard. East of Port Jackson, New South Wales, 77 - 154 metres. Holotype, X 12.4. A.M. No. C72565.
2. *Colpospira (Colpospira) tristira* (Tate). Fossil Bluff, Table Cape, near Wynyard, Tasmania. Holotype, X 1.2. Tate Museum, University of Adelaide, Geology Dept., Reg'd No. T.1419B.
3. *Colpospira (Colpospira) calcaria* Garrard. Fossil Beach, Balcombe Bay, Mornington Peninsula, Victoria. Holotype, X 8. N.M.V. No. P27458.
4. *Colpospira (Colpospira) platyspira* (Tenison-Woods). Clifton Bank, Muddy Creek, west of Hamilton, Victoria. Topotype, X 5.1. N.M.V. No. P26986.
5. *Colpospira (Colpospira) conspicabilis* (Tate). Bed b, Cutting on Prince's Highway, North-east side of Bunga Creek, Lakes Entrance, Victoria. Figured specimen, X 1.9. N.M.V. No. P26997.
6. *Colpospira (Colpospira) platyspiroides* Ludbrook. Abattoirs Bore, Adelaide, South Australia. Paratype, X 6.8. T.M. No. F15156.
7. *Colpospira (Acutospira) acicis* (Watson). Off Twofold Bay, New South Wales, 73 metres. Figured specimen, X 2.5. A.M. No. C77376.
8. *Colpospira (Acutospira) atkinsoni* (Tate and May). East of Babel Island, Bass Strait, 118 metres. Figured specimen, X 2.9. A.M. No. C77378.
9. *Colpospira (Acutospira) smithiana* (Donald). 27½ miles east of Sydney, New South Wales, 457-549 metres. Figured specimen, X 6.4. A.M. No. C24430.
10. *Colpospira (Acutospira) yarramundi* Garrard. South-east of Lakes Entrance, Victoria, 154 metres. Holotype, X 11.7. A.M. No. C72591.
11. *Colpospira (Platycolpus) acinella* (Chapman and Crespin). Sorrento Bore (Nepean No. 1), Victoria, 1,400 feet. Topotype, X 19.7. N.M.V. No.
12. *Colpospira (Platycolpus) circumligata* (Verco). East of King Island, Bass Strait, 58 metres. Figured specimen, X 4. A.M. No. C77382.
13. *Colpospira (Platycolpus) congelata* (Adams and Reeve). 7 miles north of Long Island, near Onslow, Western Australia, 50 metres. Figured specimen, X 3.1. W.A.M. No. 365-69.
14. *Colpospira (Platycolpus) quadrata* (Donald). Off Twofold Bay, New South Wales, 45-54 metres. Figured specimen, X 3.9. A.M. No. C77380.
15. *Colpospira (Platycolpus) warburtonii* (Tenison-Woods). Topotype, X 2.5. N.M.V. No. P27454.
16. *Colpospira (Platycolpus) warburtonii* (Tenison-Woods). Topotype, X 2.9. N.M.V. No. P27006.
17. *Colpospira (Platycolpus) warburtonii* (Tenison-Woods). Topotype, X 3. N.M.V. No. P27453. Above three Topotypes from Fossil Bluff, Table Cape, near Wynyard, north-west Tasmania.



Colpospira (Colpospira) conspicabilis (Tate, 1893)

Pl. 27, fig. 5.

- 1893 *Turritella conspicabilis* Tate, *Trans. R. Soc. S. Aust.*, 17: 339, pl. 8, fig. 7.
 1935 *Turritella conspicabilis*. Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 380.
 1957 *Turritella conspicabilis*. Marwick, *Proc. Mal. Soc. Lond.*, 32: 153.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ smooth globose whorls, nucleus not submerged. TELEOCONCH 13 whorls, all flatly convex. SUTURES well impressed. SCULPTURE — first four whorls smooth with indefinite cord at base which becomes increasingly heavy with age; usually three strong striations develop above the basal cord, with a number of very fine striae over the whole whorl, all crossed by fine, dense lines of growth. APERTURE sub-quadrate; columella arcuate, inner lip a little reflected at base; outer lip thin and crenulated exteriorly by cords, typical sinus. BASE of shell with numerous strong but fine lirae crossed by numerous growth lines.

Type locality: "Gippsland Lakes", precise locality not known. Mitchellian-Cheltenhamian: Upper Miocene. (T. A. Darragh, pers. comm., 29/10/69).

Dimensions: Holotype, length 41.1 mm, breadth 10.9 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T.1416C.

Material: 4 topotypes, National Museum of Victoria, Melbourne.

Discussion: Notes by the author (Tate): "Though associated with *T. tristira* at Gippsland Lakes, and not with it elsewhere, as there are no decided intermediate stages, I have somewhat reluctantly considered it a distinct species. A varietal form, if not a distinct species, occurs abundantly at Spring Creek, which differs by less prominent keel. It makes some approach to that variety of *T. runcinata*, in which the front keel is conspicuously elevated, but the whorls are more quadrate, the keel truncated on the edge, whilst the spiral striae are fewer and not wavy interrupted." My own comments are that this species could well be the direct ancestor of *C. runcinata*. The primary whorls in this species are flat and not flatly convex as in *C. runcinata*, but general whorl structure and spirals are very similar.

Colpospira (Colpospira) platyspiroides Ludbrook, 1957

Pl. 27, fig. 6.

- 1957 *Colpospira platyspiroides* Ludbrook, *Trans. R. Soc. S. Aust.*, 80: 19, pl. 2, fig. 12.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ smooth globose whorls, shining, nucleus not submerged. TELEOCONCH approx. 17 whorls, smooth, shining, flattish, rather restricted posteriorly. SUTURES a little impressed. SCULPTURE — early whorls slightly carinate in anterior quarter, a second keel later developing in posterior quarter, area between is flat and smooth except for occasional very fine spiral threads, crossed by fine flexuous growth lines. APERTURE sub-quadrate; columella slightly arcuate, inner lip a little reflected at base; outer lip thin with typical sinus. BASE of shell with sharply angulate periphery, flattish, six fine spiral lirae crossed by fine growth lines.

Type locality: Abattoirs Bore, Adelaide, South Australia. Dry Creek Sands: Yatalan: Upper Pliocene.

Turritellidae

Dimensions: Holotype, length — estimated total 18.5 mm, breadth 5 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. F.15156.

Material: 2 paratypes from type locality, Tate Museum, as above.

Discussion: Observations by the author: "The four examples of this species were previously referred to *C. platyspira* Tenison-Woods, from which the species differs in being larger and thicker, with a wider spire more gradually tapering than that of *C. platyspira*. The sculpture also differs."

Subgenus ACUTOSPIRA Kotaka, 1959

ACUTOSPIRA Kotaka, 1959, *Sci. Rep. Tohoku Univ.*, (2). 31: 101. Type species by original designation *Turritella okadai* Nagao, 1928.

Subgeneric characteristics. Similar in nearly all respects to main genus *Colpospira*, except that spiral cords are replaced by sharp-edged prominent keels. In the five species now included in this subgenus, B is always the first spiral to emerge, followed by either A, C or C, A. This contrasts with the main genus *Colpospira*, where the spiral C, if visible, emerges first, and confirms the necessity for the introduction of this subgenus. Whether this also applies to species outside Australia is unknown.

Colpospira (Acutospira) accisa (Watson, 1881)

Pl. 27, fig. 7.

1881 *Turritella accisa* Watson, *Jour. Linn. Soc. Lond.*, 15: 220.

1886 *Turritella accisa*. Watson, *Rep. Sci. Res. Challenger, Zool.*, 25: 476, pl. 30, fig. 4.

1924 *Colpospira accisa*. Iredale, *Proc. Linn. Soc. N.S.W.*, 49: 249.

1931 *Colpospira accisa*. Cotton and Godfrey, *S. Aust. Naturalist*, 12: 57.

Description: PROTOCONCH asymmetric, of two smooth globose whorls, nucleus not submerged. TELEOCONCH 16 whorls, convex towards base of whorls, spire straight sided. SUTURES sharply impressed. SCULPTURE — a strong keel in centre and another towards base, commencing on first whorl, a smaller at top commencing on first or second whorl; from about fourth whorl onwards various striations commence above, below and between the keels, but three main keels remain dominant throughout, the lowest tending to bifurcate on gerontic whorls. APERATURE sub-quadrate; columella fairly straight, inner lip strongly reflected at base; outer lip thin and crenulate with typical sinus. BASE of shell flatly convex with strong peripheral cord; numerous fine, even concentric striations crossed by faint growth lines. COLOUR an overall cream, fawn or light reddish-brown; some specimens with reddish irregular spotting on keels and striations. OPERCULUM from a half-grown specimen is circular, approx. 2 mm diameter, dark brown, gelatinous, four rough heavy concentric ridges inwards from edge, several finer ones surrounding solid, slightly raised central nucleus.

Type locality: Bass Strait, off East Moncoeur Island, 38-40 fathoms (69-73 metres).

Dimensions: Holotype, length 29.2 mm, breadth 8.6 mm, British Museum (Natural History), Reg'd No. 1887.2.9.1498-1500.

Distribution: Central New South Wales coast southward to Victoria, Tasmania, South Australia and southern Western Australia.

Material: Large quantity of specimens from six State Museums.

Discussion: Specimens examined from southern New South Wales and Victoria follow Watson's description quite well, the central and lower main cords being strong and sharp, the upper tending usually to be a little broader and more flattened. Specimens from 70 metres off Cape Borda, South Australia, tend to have the strongest keel at the base, the central keel replaced by two or even three lesser keels, accompanied by the numerous fine striae as usual. No difficulty should be experienced in separating this strongly keeled species from the closely allied *C. runcinata* (Watson), with its almost smooth golden-yellow and then white primary whorls.

Colpospira (Acutospira) atkinsoni (Tate and May, 1900)

Pl. 27, fig. 8.

- 1876 *Turritella tasmanica* Tenison-Woods, *Proc. R. Soc. Tas.*, (1875), p. 140.
 1900 *Turritella atkinsoni* Tate and May, *Trans. R. Soc. S. Aust.*, 24: 95. (New name for *T. tasmanica* Tenison-Woods, 1876, non Reeve, 1849).
 1900 *Turritella (Colpospira) godeffroyana* Donald, *Proc. Mal. Soc. Lond.*, 4: 53, pl. 5, figs. 6, 6a.
 1901 *Turritella atkinsoni*. Tate and May, *Proc. Linn. Soc. N.S.W.*, 26: 378, pl. 23, figs. 15-17.
 1910 *Colpospira atkinsoni medioangulata* Verco, *Trans. R. Soc. S. Aust.*, 34: 125, pl. 30, figs. 8, 9.
 1962 *Stiracolpus atkinsoni*. Macpherson and Gabriel, *Mar. Moll. Vict.*, p. 97, text fig. 122.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ glassy convex whorls, nucleus slightly submerged. TELEOCONCH 14 whorls, all medially angulate and inflated. SUTURES lightly impressed. SCULPTURE — a strong, sharp and heavy keel emerges in centre of first whorl, followed by a further keel towards base of second whorl, and a third above central keel on about fifth whorl; the central keel always remains strongly predominant; further striations develop at intervals, of varying strength and in an irregular manner. APERTURE sub-circular; columella arcuate, inner lip reflected at base; outer lip thin with typical sinus. BASE of shell a little convex, periphery strongly keeled, up to 10 rather vague and irregular concentric striae crossed by numerous growth lines. COLOUR off-white, cream or medium brown. OPERCULUM circular, approx. 2.2 mm diameter, medium brown, thin and papery, with numerous overlapping irregular concentric ridges; central nucleus solid and strongly elevated.

Type locality: Tasmania.

Dimensions: Holotype ("*tasmanica*" of Tenison-Woods), length 14.8 mm, breadth 4 mm, Tasmanian Museum, Hobart, Reg'd. No. 7879/E538.

Distribution: Off Port Jackson, New South Wales, southwards to Victoria and Tasmania.

Material: Large quantity from five State Museums.

Discussion: In line with the suggestion by Tate and May (1901: 378) that the species named *C. (A.) godeffroyana* Donald, 1900, was an individual variation of *C. (A.) atkinsoni*, I support their contention and hereby designate a neotype of *C. (A.) godeffroyana* for the following reasons:

(1) No other recent Australian species in the family has the sharp and boldly prominent medial keel on each whorl, persisting throughout the length of the shell and setting it quite apart.

Turritellidae

(2) The description and other data given above for the species *C. (A.) atkinsoni* ensure recognition of the specimen designated without difficulty, and conform also to the original description and other data given for *C. (A.) godeffroyana* Donald.

(3) The holotype of *C. (A.) godeffroyana* in the Godeffroy collection was a unique specimen, which was destroyed during the loss of the Hamburg Museum by bombing in January 1943. This has been verified by enquiries from the present Director of the Museum.

(4) The neotype has been carefully chosen from a quantity of material available, and conforms as closely as practicable to the measurements, number of whorls and other description of the lost holotype.

(5) The neotype has been selected from dredgings made by "Endeavour" in 1912, from 65 fathoms east of Babel Island, Bass Strait, which is as close as practicable to the original type locality, designated merely as Bass Strait.

(6) The neotype is the property of, and is preserved in, the Australian Museum, Sydney, where it is registered No. C.78948.

Colpospira (Acutospira) smithiana (Donald, 1900)

Pl. 27, fig. 9.

1900 *Turritella (Colpospira) smithiana* Donald, *Proc. Mal. Soc. Lond.*, 4: 52, pl. 3, fig. 1.1931 *Stiracolpus smithianus*. Cotton and Godfrey, *S. Aust. Naturalist*, 12: 58.

Description: PROTOCONCH asymmetric, of two glassy globose whorls, nucleus not submerged. TELEOCONCH 12 angularly convex whorls, spire straight sided. SUTURES well impressed. SCULPTURE — one extremely strong and sharp keel commences in centre of first whorl with a smaller keel above; a third keel develops on third whorl towards the base, and a fourth keel at top of fourth whorl; a few microscopic striae develop in places on last two or three whorls. APERTURE sub-circular; columella rather strongly arcuate, inner lip reflected as a glaze on to body-whorl and strongly at base; outer lip thin, crenulated exteriorly by cords, with typical sinus. BASE of shell convex, six or seven strong irregular concentric striations crossed by numerous growth lines. COLOUR translucent white when live-taken, later becoming opaque white. OPERCULUM circular, approx. 1.4 mm diameter, medium brown, thin and papery with numerous overlapping irregular concentric ridges; central nucleus solid and slightly elevated.

Type locality: Off Sydney, New South Wales, 410 fathoms (750 metres).

Dimensions: Holotype, length 9.5 mm, breadth 3 mm, British Museum (Natural History), Reg'd. No. 1889.10.26.56-88.

Distribution: From southern Queensland through New South Wales to Victoria, Tasmania, South Australia and the southern coast of Western Australia, in depths from fairly shallow water down to 1,464 metres.

Material: Large quantities from six State Museums.

Discussion: This species was described from the disputed "Challenger" station 164B in 410 fathoms off Sydney Harbour, and was consequently on the doubtful list for some years. However it has proved to be a widespread species as shown above. The sculpture of four equally

strong keels is not constant, this applying to only say 60% of specimens; others have the central two considerably stronger, whilst others again have the first central keel to emerge predominant throughout. Hedley had specimens from 800 fathoms east of Sydney confirmed by Mrs. Longstaff (née Donald), and I have since had further specimens compared with the holotype. The original drawing of this species at pl. 5, fig 1 is decidedly misleading, the keels being shown as far weaker than they actually are, whilst the drawing of "*godeffroyanus*" at fig. 6 is extremely like *C. (A.) smithiana*. Specimens from 300 fathoms 120 miles west of Eucla, Western Australia, tend to have all keels of equal strength, with more space above and below the sutures. This species bears a superficial resemblance to the new species next described, the differences being shown under discussion of that species.

Colpospira (Acutospira) yarramundi sp. nov.

Pl. 27, fig. 10.

Description: PROTOCONCH paucispiral, asymmetric of $1\frac{1}{2}$ convexly rounded whorls, translucent white, nucleus not submerged. TELEOCONCH ten whorls, flatly convex to commence, increasing in convexity later, sides of spire straight. SUTURES very lightly impressed. SCULPTURE commences on first main whorl in form of a strong keel a little below centre, followed on second whorl by a fine keel above it which gradually increases in strength, until nearly equal to first keel by time fifth whorl is reached; a further keel commences below main keel on about fifth whorl, usually becoming about half-way in prominence between the other two; a fourth weak keel emerges above lower suture about ninth whorl. APERTURE sub-circular; columella arcuate, inner lip strongly reflected; outer lip crenulated exteriorly by keels and striations, labial sinus deep and narrow, and typical of the genus; basal portion of outer lip curves downward to form a slight canal at junction with base of inner lip. BASE of shell a little convex with three or four fine concentric threads crossed by faint growth striae. COLOUR — whole shell usually pure white and shining, some specimens tinged light to medium chestnut. OPERCULUM unavailable.

Type locality: 154 metres south-east of Lakes Entrance, Victoria.

Dimensions: Holotype, length 5.4 mm, breadth 1.4 mm, Australian Museum, Sydney, Reg'd. No. C.72591.

Distribution: From north of Cape Moreton, southern Queensland, through New South Wales to south-east of Lakes Entrance, Victoria, in depths ranging from 75 to 550 metres, the last being $27\frac{1}{2}$ miles east of Port Jackson, New South Wales.

Material: Large quantity from five State Museums.

Discussion: This widespread small species bears a superficial resemblance to the larger *C. (A.) smithiana* (Donald), in the number and disposition of the sharp keels on the last three or four whorls. However, whereas the three main keels of *C. (A.) smithiana* are prominent from the second or third whorl, the three main keels of this species appear one at a time, and achieve somewhat equal prominence only from about the sixth whorl onwards. A weak thread appears above the uppermost keel and another between the two lowest keels in a number of specimens on

Turritellidae

the body-whorl and penultimate. The appearance of the three sharp keels on this species also separates it without difficulty from *C. wollumbi* Garrard, which has four rounded cords commencing almost simultaneously. The specific name is a New South Wales aboriginal noun meaning "Deep water."

Subgenus *PLATYCOLPUS* Donald, 1900

PLATYCOLPUS Donald, 1900, *Proc. Mal. Soc. Lond.*, 4: 54. Type species by original designation *Turritella (Colpospira) quadrata* Donald, 1900.

Subgeneric characteristics. Very small to medium. General characteristics as for main genus *Colpospira*, except that labial sinus is broader and shallower, medial, and orthocone (Fig. 3). Primary spirals emerge in order B, C, A or B, A, C; quite clear as former in fossil *C. (P.) warburtonii* and as the latter in *C. (P.) multicincturalis*; difficult to detect in recent *C. (P.) quadrata* (type) and *C. (P.) circumligata*.

Colpospira (Platycolpus) quadrata (Donald, 1900)

Pl. 27, fig. 14.

- 1900 *Turritella (Colpospira) quadrata* Donald, *Proc. Mal. Soc. Lond.*, 4: 53, pl. 5, fig. 8, 8a, 8b.
 1900 *Turritella (Colpospira) quadrata* subsp. *scitula* Donald, *Proc. Mal. Soc. Lond.*, 4: 54, pl. 5, fig. 9.
 1924 *Colpospira quadrata*. Iredale, *Proc. Linn. Soc. N.S.W.*, 49: 249.
 1931 *Platycolpus quadratus*. Cotton and Godfrey, *S. Aust. Naturalist*, 12: 58, pl. 2, fig. 3.
 1950 *Platycolpus quadratus*. Allan, *Aust. Shells*, p. 92, text fig. 2.
 1957 *Platycolpus quadratus*. Marwick, *Proc. Mal. Soc. Lond.*, 32: 157, text fig. 51.
 1962 *Colpospira quadrata*. Macpherson and Gabriel, *Mar. Moll. Vict.*, p. 99.

Description: PROTOCONCH asymmetric, two smooth white convex whorls, nucleus not submerged. TELEOCONCH 11 whorls, first three or four slightly convex, balance a little concave between ridges, spire straight sided. SUTURES slightly impressed at base of deep V-notch. SCULPTURE commences with several fine spiral striae on third whorl, followed by a strong cord above suture near base of whorl and another below suture towards top of whorl; cords continue to increase in strength, and intervening space increases in concavity; striations continue as fine threads, increasing in number above, below and between the ridges. APERTURE sub-circular; columella strongly arcuate, inner lip strongly reflected on to body-whorl and at base; outer lip thin, curving strongly round base, and with typical sinus. BASE of shell strongly convex with numerous slightly gemmate flat striae, due to intersection with closely packed growth lines. COLOUR light yellow, lightly flamed with brown, with deeper brown spots on both ridges; protoconch translucent white. OPERCULUM circular with black-brown base, elevated central nucleus having central depression, 16 or more cream concentric overlapping incremental ridges, extremely thin and papery.

Type locality: Bass Strait, 45 fathoms (82 metres).

Dimensions: The author states that the length of a medium sized specimen is 19 mm, and breadth 6.5 mm. The Holotype is in the British Museum (Natural History), Reg'd. No. 1969271.

Distribution: Victoria, Tasmania, South Australia and New South Wales northwards to mid-coast, in varying depths from a few metres to 860 metres ("Endeavour" 1912, off Green Cape, New South Wales).

Material: Large quantity from six State Museums.

Discussion: Although this species appears to be confused quite frequently with *Colpospira sinuata* (Reeve), it can be separated on sight by the clean-cut and deep V-notch at the sutures, and the central concavity between the ridges on each whorl after about the first four. The species varies very little throughout its range. The subspecies *C. (P.) scitula* (Donald) is obviously only a specimen with slightly brighter markings and the whorls a little more concave, which can be seen many times over in a long series of specimens. The fine transverse striae vary a little in intensity, and the angle of the spire can vary from 4.5° to 5.5° , otherwise it is a constant species.

Colpospira (Platycolpus) circumligata (Verco, 1910)

Pl. 27, fig. 12.

- 1910 *Turritella circumligata* Verco, *Trans. R. Soc. S. Aust.*, 34: 123, pl. 30, figs. 3, 4.
 1931 *Colpospira circumligata*. Cotton and Godfrey, *S. Aust. Naturalist*, 12: 57.

Description: PROTOCONCH paucispiral, asymmetric, $1\frac{1}{2}$ to 2 smooth globose translucent whorls, nucleus prominent. TELEOCONCH 11 whorls, a little convex. SUTURES linear, very slightly canaliculate in early whorls. SCULPTURE becomes prominent about fifth whorl, consisting of a broad heavy rounded cord below suture, below which are two similar but smaller cords with flat space of equal width between them; largest cord is below these, higher and more rounded than the large posterior one, sloping inwards towards lower suture; the whole is crossed by densely packed prominent growth striae. APERTURE sub-quadrate; columella arcuate, inner lip strongly reflected towards base; outer lip thin, crenulated exteriorly by cords, and with typical sinus. BASE of shell roundly convex, with up to 9 broad flat striae crossed by numerous growth lines. COLOUR pale yellow-brown with darker brown spirals between cords, a broad brown spiral over centre of base. OPERCULUM unavailable.

Type locality: Off Beachport, South Australia, 110 fathoms (200 metres).

Dimensions: Holotype, length 17mm, breadth 6 mm, South Australian Museum, Reg'd. No. D.13429.

Distribution: South Australia and Bass Strait.

Material: Holotype and several paratypes, South Australian Museum; two paratypes and one other, Australian Museum, Sydney.

Discussion: This beautifully sculptured small species is quite rare in dredgings. The only specimen obtained by "Gascoigne" in 1962 and given to the Australian Museum came from 58 metres east of King Island, Bass Strait, and is a clear translucent white. Examination of the holotype in the South Australian Museum shows it now to be a uniform pale cream in colour, due to fading since the original description. The species does not appear to have any close relatives.

This species was recorded by Chapman and Gabriel (1914: 323) from 3,226 feet in the Mallee Bore, but was a case of mis-identification.

Turritellidae

Colpospira (Platycolpus) congelata (A. Adams and Reeve, 1848)

Pl. 27, fig. 13.

- 1848 *Turritella congelata* A. Adams and Reeve, *Voy. Samarang*, Zool., p. 47, pl. 12, fig. 2.
 1849 *Turritella congelata*. Reeve, *Conch. Icon.*, 5, pl. 11, fig. 59.
 1886 *Turritella congelata*. Tryon, *Man. Conch.*, 8: 204, pl. 64, fig. 94.

Description: PROTOCONCH asymmetric, of two whorls, flatly rounded, nucleus prominent. TELEOCONCH 16 whorls, convex, first four strongly centrally carinate, balance becoming flatter with maturity. SUTURES impressed. SCULPTURE — one strong cord just below centre on first four whorls, becoming a raised striation from then on; a further striation both above and below this on succeeding whorls; three or four striae follow, but first three remain predominant, all crossed by sinuous densely packed but faint growth lines. APERTURE sub-quadrate, columella straight, inner lip slightly recurved at base; outer lip thin with typical sinus. BASE of shell flatly convex, three strong striae next to peripheral edge, further six or seven indistinct striae towards centre, crossed by faint growth lines. COLOUR opaque white, mature whorls somewhat translucent, three main spirals tipped with yellow-brown. OPERCULUM unavailable.

Type locality: China Sea.

Dimensions: Figured specimen — holotype, length 36.5 mm, breadth 10.5 mm, British Museum (Natural History), Reg'd. No. unavailable.

Distribution: The only specimens now recorded from the Australian coast are: 7 miles north of Long Is., Onslow, 47 metres, 4 specimens; 20 miles north of Delambre, Dampier Archipelago, 42 metres, 1 specimen; both localities in Western Australia.

Material: Five specimens in Western Australian Museum as above.

Discussion: Although only five specimens of this species have been examined from the collection of "Western Australian — Hawaiian Expedition" as above, one specimen in particular is almost fully grown and in very good condition. The illustration and description of the species leaves no room for doubt as to its identity. The thin, frail construction of the shell sets it apart from any other species in Australian waters.

FOSSIL SPECIES

Colpospira (Platycolpus) warburtonii (Tenison-Woods, 1877)

Pl. 27, fig. 15-17; Pl. 30, fig. 9.

- 1877 *Turritella warburtonii* Tenison-Woods, *Pap. Proc. R. Soc. Tas.*, (1876), p. 99; *ibid* = *T. sturtii* Tenison-Woods, 1877.
 1893 *Turritella warburtonii*. Tate, *Trans. R. Soc. S. Aust.*, 17: 337, pl. 8, fig. 2; *ibid.* = *T. sturtii* Tenison-Woods, 1877, p. 338, pl. 8, fig. 6.
 1896 *Turritella warburtonii*. Pritchard, *Proc. R. Soc. Vict.*, 8: 113-4; *ibid.* = *T. sturtii* Tenison-Woods, 1877.
 1935 *Turritella (Ctenocolpus) warburtonii*. Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 377-80; *ibid.* = *T. (C.) sturtii* Tenison-Woods, 1877.
 1957 *Ctenocolpus warburtonii*. Marwick, *Proc. Mal. Soc. Lond.*, 32: 153; *ibid.* = *C. sturtii* Tenison-Woods, 1877.

Description: PROTOCONCH asymmetric, of 2½ smooth convex whorls, nucleus slightly submerged. TELEOCONCH 15 whorls, varying from

flatly convex to a little concave, sides of spire flat to slightly concave. SUTURES deeply impressed. SCULPTURE varies considerably, from three to eight cords and striations, some granulose, some smooth: the commonest form taken by the sculpture is two heavy cords towards the base of each whorl, one or both smooth or granulose, a further lighter cord just below the upper suture, with intervening space concave, sometimes with minor striae, sometimes completely smooth; other specimens with flatly convex whorls, up to eight striations of varying importance; other specimens fall between these extremes. APERTURE sub-quadrate; columella almost straight, inner lip a little reflected at base; outer lip crenulated exteriorly by cords, with typical sinus. BASE of shell flat with up to ten concentric striae of varying prominence, crossed by numerous growth lines.

Type locality: Fossil Bluff, Table Cape, near Wynyard, Tasmania. Table Cape Group: Janjukian/Longfordian: Upper Oligocene/Lower Miocene.

Dimensions: Holotype, length 14 mm, breadth 4 mm. (Holotype of *C. (P.) sturtii*, length 22 mm, breadth 5.25 mm). Both holotypes should be in the Tasmanian Museum, Hobart, but are reported to be lost.

Material: 11 topotypes National Museum of Victoria, Melbourne. Large quantity of topotypes Australian Museum, Sydney.

Discussion: This most variable species appears to have been the subject of a great deal of argument and speculation since it was named as two distinct species by Tenison-Woods in 1877. Cotton and Woods (1935: 377-9) commented on a number of specimens from the Singleton collection and finally adopted an arbitrary method of separation. They declared that all specimens with two prominent keels at the base of each whorl, either smooth or granulose, were *C. (P.) warburtonii*, and all those with more than two ribs, except where the anterior pair are very strongly developed, were to be placed in *C. (P.) sturtii*. An argument such as this, where no distinct dividing line is given, cannot be sustained; furthermore the fact that they placed all specimens with two strong keels, either smooth or granulose, under *C. (P.) warburtonii*, is directly in conflict with Tenison-Woods' original description of that species, where he placed the words "two smooth" (ribs) in italics to emphasise one manner in which it differed from *C. (P.) sturtii*.

I have carefully examined a long series of this species, from the type locality, in the Australian Museum collection. Specimens agreeing well with both the original descriptions are included, in addition to every possible intergrade; the protoconchs and primary whorls of all specimens are identical, and no clear-cut dividing line is evident. I conclude that there is only one species having a most variable sculpture, and with whorls varying from a little convex to fairly concave, and the two names must be considered synonymous.

Colpospira (Platycolpus) acinella (Chapman and Crespin, 1928)

Pl. 27, fig. 11

1928 *Turritella acinella* Chapman and Crespin, Rec. Geol. Surv. Vict., 5: 115, pl. 8, fig. 45.

Description: PROTOCONCH asymmetric, of two smooth flatly globose whorls, nucleus slightly submerged. TELEOCONCH 8 flat whorls. SUT-

Turritellidae

URES a fine impressed line. SCULPTURE — first whorl strongly centrally unicarinate, on second or third whorl further strong cords develop at both top and bottom, all persisting strongly on to body-whorl; whorls are otherwise smooth with growth striae barely discernible. APERTURE sub-circular; columella slightly arcuate, inner lip reflected at base; outer lip thin, crenulated exteriorly by cords, with typical sinus. BASE of shell flat with strong peripheral cord and three or four smaller striations, crossed by numerous growth lines.

Type locality: Sorrento Bore (Nepean No. 1), Victoria, 1,310 feet. Fyansford Formation: Bairnsdalian: Middle Miocene.

Dimensions: Holotype, length 4.5 mm, breadth 1.7 mm, National Museum of Victoria, Melbourne — reported lost.

Material: Four topotypes, National Museum of Victoria.

Discussion: The original description states that the median rib in this species is the strongest; it emerges first but the anterior rib (or cord) is often of equal strength after about fourth whorl. In others the posterior cord can become equal to the median by about sixth whorl whilst the anterior cord remains depressed. Strength of cords in relation to each other is a variable feature. This very small species resembles *C. (P.) medioplicatilis* (Chapman and Crespin), and is of the same age and from same type locality, however that species lacks the posterior cord, and the cords are less acute and more rounded.

Colpospira (Platycolpus) medioplicatilis (Chapman and Crespin, 1928)

Pl. 30, fig. 6.

1928 *Turritella medioplicatilis* Chapman and Crespin, *Rec. Geol. Surv. Vict.*, 5: 116, pl. 8, fig. 47.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ flatly convex whorls, nucleus a little submerged. TELEOCONCH 11 whorls, flatly convex, spire straight sided. SUTURES well impressed. SCULPTURE — first five whorls strongly centrally unicarinate, further strong cord develops at base on about sixth whorl, later "moving" a little adapically, with smooth area between cords, also area above upper cord, strongly concave; one or two striations form below upper suture on later whorls; growth striae very faint. APERTURE sub-circular; columella slightly arcuate; outer lip thin with typical sinus. BASE of shell a little concave with three or four vague striations crossed by fine growth lines.

Type locality: Sorrento Bore (Nepean No. 1), Victoria, 1,461 feet. Fyansford Formation: Bairnsdalian: Middle Miocene.

Dimensions: Holotype, length 3.25 mm, breadth at base 1 mm, National Museum of Victoria, Melbourne, Reg'd. No. P. 14465.

Material: One paratype National Museum of Victoria, Melbourne.

Discussion: This minute species appears difficult to obtain at the type locality, the amount of material available for study apparently being very limited. However the specimen available is quite distinct from its closest relative, *C. (P.) acinella* as shown above.

Colpospira (Platycolpus) multicincturalis (Chapman and Crespin, 1928)

Pl. 28, fig. 1.

1928 *Turritella multicincturalis* Chapman and Crespin, *Rec. Geol. Surv. Vict.*, 5: 116, pl. 8, fig. 46.

Description: PROTOCONCH asymmetric, of two globose whorls, nucleus not submerged. TELEOCONCH 14 whorls, flat and depressed, sides of spire straight. SUTURES moderately impressed. SCULPTURE of primary whorls strongly bicarinate, lower cord the stronger, two or three other cords later developing with a few finer striations in a somewhat irregular manner; sub-central cord is always predominant; growth striae extremely faint even on mature whorls. APERTURE sub-circular; columella arcuate, inner lip a little reflected at base; outer lip a little thickened and crenulated by cords, with typical sinus. BASE of shell flat with up to six fine flattened striae crossed by fine growth lines.

Type locality: Sorrento Bore (Nepean No. 1), Victoria, 741 feet. Flynsford Formation: probably Cheltenhamian: Upper Miocene.

Dimensions: Holotype, length 7 mm, breadth 2.25 mm, National Museum of Victoria, Melbourne, Reg'd. No. P.14464.

Material: 3 paratypes National Museum of Victoria, Melbourne.

Discussion: The order of emergence of the primary spirals for the recent *C. (P.) quadrata* (Donald), the type for this subgenus, is very vague and difficult to detect, but B is the first to emerge, quickly becoming submerged again with other fine striations. The within species differs from the fossil *C. (P.) warburtonii* (Tenison-Woods) in that the order of emergence is B, A, C as against B, C, A for *C. (P.) warburtonii*. However the labial and basal sinuses together with the protoconch show that (*Platycolpus*) is the only available subgenus for this species. It does not appear to have any near relatives in the Miocene or Pliocene.

Colpospira (Platycolpus) trilix (Cotton and Woods, 1935)

Pl. 28, fig. 2.

1935 *Turritella (Ctenocolpus) trilix* Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 377, text fig. 4.1952 *Ctenocolpus trilix*. Cotton, *Geol. Surv. S. Aust., Bull.*, 27, Append. 4: 245.1954 *Turritella (Ctenocolpus) trilix*. Ludbrook, *Trans. R. Soc. S. Aust.*, 77: 59.1957 *Ctenocolpus trilix*. Ludbrook, *Trans. R. Soc. S. Aust.*, 80: 18.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ smooth globose whorls, nucleus prominent. TELEOCONCH 10 flat whorls, spire straight sided. SUTURES deeply incised. SCULPTURE (specimens from type locality) — one heavy broad cord at top and bottom of each whorl, both of which commence to bifurcate after second whorl; the upper pair remain equal in strength, the lower two usually finish with the anterior cord decidedly heavier than the other; space between the two pairs is decidedly concave; one or two very fine striations appear irregularly; incremental striae difficult to detect. APERTURE sub-circular; columella arcuate, inner lip reflected at base; outer lip thin with typical sinus. BASE of shell convex with up to 12 irregular sized striae crossed by almost straight lines of growth.

Type locality: Abattoirs Bore, Adelaide, South Australia, 300-500 feet. Dry Creek Sands: Yatalan: Upper Pliocene.

Dimensions: Holotype, length 6.5 mm, breadth 2.5 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T.1675.

Turritellidae

Material: Four topotypes, National Museum of Victoria.

Discussion: The disposition of the cords on specimens examined from the type locality as described above, is somewhat at variance with the original description, which was rather loosely worded and not specific. Specimens examined from other localities also fit the above description well and the species is apparently a lot less variable than many others in the family. It does not appear to have any near relatives.

Subgenus *CTENOCOLPUS* Iredale, 1925

CTENOCOLPUS Iredale, 1925, *Rec. Aust. Mus.*, 14: 266. Type species by original designation *Turritella australis* Lamarck.

Subgeneric characteristics: Shells very small to medium. It is considered that *Ctenocolpus* can only be regarded as a further subgenus of *Colpospira*; the basal sinus compared with that of the subgenus *Platycolpus* is very similar but the labial sinus is prosocline to a small extent (fig. 4). Also the primary spiral C emerges first in this subgenus in lieu of B as in *Platycolpus*, and the spiral cords are frequently gemmate.

Colpospira (Ctenocolpus) australis (Lamarck, 1822)

Pl. 28, fig. 3.

- 1822 *Turritella australis* Lamarck, *Hist. Anim. s. Vert.*, 7: 59.
 1873 *Turritella australis*. Kiener and Fischer, *Coq. Viv.*, 9: 36, pl. 4, fig. 3.
 1876 *Turritella granulifera* Tenison-Woods, *Pap. Proc. R. Soc. Tas.*, (1875), p. 143.
 1886 *Turritella australis*. Tryon, *Man. Conch.*, 8: 207, pl. 65, fig. 23.
 1893 *Turritella terebellata* Tate, *Trans. R. Soc. S. Aust.*, 17: 336, (non Lamarck, 1804).
 1900 *Turritella australis*. Randles, *Proc. Mal. Soc. Lond.*, 4: 58.
 1925 *Turritella australis*. Iredale, *Rec. Aust. Mus.*, 14: 266.
 1925 *Turritella australis diffidens* Iredale, *Rec. Aust. Mus.*, 14: 267, pl. 43, fig. 17.
 1935 *Ctenocolpus terebellatus*. Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 376 (non Lamarck, 1804).
 1962 *Ctenocolpus australis*. Macpherson and Gabriel, *Mar. Moll. Vict.*, p. 97, text fig. 121.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ globose whorls, nucleus a little submerged. TELEOCONCH 13 whorls, early whorls flatly globose, later becoming concave medially, spire straight sided. SUTURES deeply incised. SCULPTURE — a crenulated cord develops at base of fourth whorl, closely followed by a lesser crenulated cord at top; both gradually increase in strength, becoming bold, prominent and gemmate, and causing a decidedly concave space between; lower cord remains predominant; specimens from type locality, southern Tasmania, develop a third smooth minor cord between lower main cord and suture, which is absent on those from Victoria and New South Wales, but not of subspecific significance. APERTURE sub-circular; columella arcuate with inner lip strongly reflected at base; outer lip thin, crenulated exteriorly by cords, and with typical sinus. BASE of shell convex with about seven flat indefinite concentric striations crossed by numerous growth lines. COLOUR yellowish-brown, darker pinkish-brown round sutures, brown band round centre of base, protoconch translucent white. OPERCULUM described by Iredale (1925: 266) as simple, concave exteriorly, horny and multispiral.

Type locality: Southern Tasmania.

Dimensions: Holotype, length 20.24 mm, breadth not stated. Information not available but understood to be held by Museum d'Histoire Naturelle, Geneva, Switzerland.

Distribution: Tasmania, South Australia, Victoria and New South Wales to central coast.

Material: Large quantity from six State Museums.

Fossil. Type locality of T. terebellata Tate: Limestone Creek, Glenelg River, Victoria. Werrikoo Member, Whalers Bluff Formation: Werrikooian: Upper Pliocene/Lower Pleistocene.

Discussion: Examination of many specimens from three States shows that incidence of nodules on the two keels varies considerably, even on different whorls in the same specimen, and many heavily noded specimens can be found living with others almost devoid of them. The subspecies *C. australis diffidens* Iredale therefore cannot be regarded as valid. The fossil species *T. terebellata* Tate cannot be separated from Victorian and New South Wales specimens of the recent *C. (C.) australis* (Lamarck), and is therefore a further synonym.

Smaller specimens of the smooth form of this species could bear a superficial resemblance to *C. (C.) guillaumei* (Iredale), and also to some specimens of the fossil *C. (C.) pagodula* (Tate) but differences between the three are fairly well marked and consistent.

Colpospira (Ctenocolpus) curialis (Hedley, 1907)

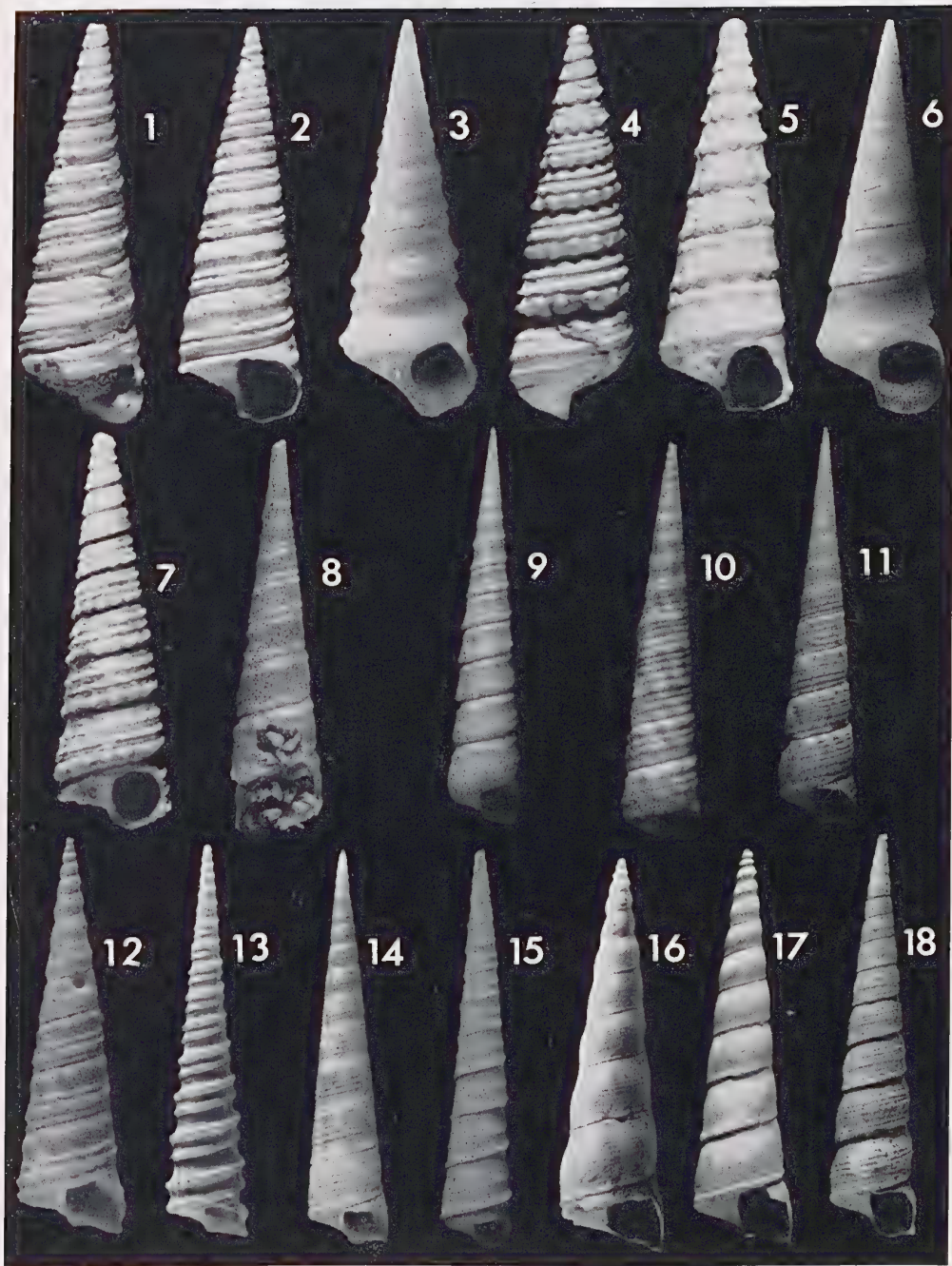
Pl. 28, fig. 4-5.

1907 *Turritella curialis* Hedley, *Rec. Aust. Mus.*, 6: 357, pl. 67, fig. 19.

Description: PROTOCONCH asymmetric, of two round, dome-shaped whorls, nucleus a little submerged. TELEOCONCH of nine slightly con-

PLATE 28

1. *Colpospira (Platycolpus) multicincturalis* (Chapman and Crespin). Sorrento Bore (Nepean No. 1), Victoria, 741 feet. Paratype, X 8.4. N.M.V. No. P27002.
2. *Colpospira (Platycolpus) trilix* (Cotton and Woods). Abattoirs Bore, Adelaide. Topotype, X 7.3. N.M.V. No. P26992.
3. *Colpospira (Ctenocolpus) australis* (Lamarck). Off Merimbula, New South Wales, 45 metres. Figured specimen, X 3.7. A.M. No. C77384.
4. *Colpospira (Ctenocolpus) curialis* (Hedley). 35 miles east of Sydney, New South Wales, 1,464 metres. Paratype, X 10. A.M. No. C26623.
5. *Colpospira (Ctenocolpus) curialis* (Hedley). 23 miles east of Sydney, New South Wales, 457 metres. Figured specimen, X 12. A.M. No. C24434.
6. *Colpospira (Ctenocolpus) guillaumei* (Iredale). Off Sow and Pigs Reef, Port Jackson, New South Wales, 16 metres. Figured specimen, X 4. A.M. No. C77383.
7. *Colpospira (Ctenocolpus) gemmulata* (Tate). Clifton Bank, Muddy Creek, west of Hamilton, Victoria. Topotype, X 11. N.M.V. No. P26988.
8. *Gazameda gunnii* (Reeve). Twofold Bay, New South Wales, 18 metres. Figured specimen, X 1.7, broken open to show embryos *in situ*. A.M. No. C77372.
9. *Gazameda gunnii* (Reeve). Stanley, north-west Tasmania. Figured specimen, X 1.1. A.M. No. C69777.
10. *Gazameda gunnii* (Reeve). Off Southport, southern Queensland, 68 metres. Figured specimen, X 1.1. A.M. No. C77369.
11. *Gazameda gunnii* (Reeve). Off Twofold Bay, New South Wales, 18 metres. Figured specimen, X 1.1. A.M. No. C77371.
12. *Gazameda declivis* (Adams and Reeve). Half-mile south-west of Doc Can Island, Sulu Archipelago, P.I. Figured specimen, X 1.2. W.A.M. No. 173-69.
13. *Gazameda iredalei* (Finlay). Glenelg Beach, South Australia. Figured specimen, X 2.7. A.M. No. C77373.
14. *Gazameda tasmanica* (Reeve). Off Port Hacking, New South Wales, 82 metres. Figured specimen, X 1.9. A.M. No. C77370.
15. *Gazameda acricula* (Tate). Murray River cliffs, 4 miles south of Morgan, South Australia. Topotype, X 1.7. A.M. No. C77389.
16. *Gazameda victoriensis victoriensis* (Cotton and Woods). 2.1 miles north-west of Point Ronald, Victoria. Grid Ref. Princetown 027, 2915. Figured specimen, X 2.9. N.M.V. No. P26993.
17. *Gazameda victoriensis manyung* Garrard. Cliff-face south of Manyung Rocks, Mornington Peninsula, Victoria. Grid Ref. Cranbourne, 106, 903. Holotype, X 3.3. N.M.V. No. P27457.
18. *Gazameda adelaidensis* (Cotton and Woods). Abattoirs Bore, Adelaide, South Australia. Topotype, X 1.9. N.M.V. No. P26991.



cave whorls, spire straight sided. SUTURES lightly impressed and crenulate, due to proximity of gemmate keel above. SCULPTURE — a cord a little below centre on first whorl, becoming crenulate from second whorl (from sixth whorl on holotype); cord "moves" abapically until it adjoins lower suture; further gemmate cord develops immediately below upper suture on last three whorls; two narrow widely spaced smooth striae on last three whorls a little above lower cord on holotype, absent on some other specimens. APERTURE sub-quadrated; columella arcuate, inner lip strongly reflected on to body-whorl; outer lip thin with typical sinus. BASE of shell flatly convex, five broad flat lirae, barely discernible, crossed by numerous growth lines. COLOUR light cream. OPERCULUM unavailable.

Type locality: 35 miles east of Sydney, New South Wales, 800 fathoms (1,464 metres).

Dimensions: Holotype, length 7 mm, breadth 2.95 mm, Australian Museum, Sydney, Reg'd. No. C.26623.

Distribution: At present only recorded from 457 and 1,464 metres, east of Sydney, New South Wales.

Material: Holotype, 5 paratypes and 2 others, all Australian Museum.

Discussion: Two specimens from 457 metres east of Sydney, New South Wales, have no sign of the two spiral lirae in evidence on the holotype and paratypes, but are definitely the same species. Evidently an archibenthal species as extensive dredgings in shallower water near the same area have failed to produce further specimens. The species does not appear to have any close relatives.

Colpospira (Ctenocolpus) guillaumei (Iredale, 1924)

Pl. 28, fig. 6.

1924 *Colpospira guillaumei* Iredale, *Proc. Linn. Soc. N.S.W.*, 49: 248, pl. 36, fig. 4, 15.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ round, dome-shaped whorls, nucleus a little submerged. TELEOCONCH 11 whorls, first four a little convex, next five or six flat, later whorls a little concave. SUTURES a little impressed within a shallow V-notch. SCULPTURE mainly of numerous incremental striae following line of outer lip; a cingulum develops at top and bottom of each whorl from about sixth onwards, increasing in strength, lower cingulum the stronger, imbricating over whorl below and producing a pagoda-like effect. APERTURE sub-quadrated; columella almost straight, inner lip reflected strongly on to body-whorl and at base; outer lip thin with typical sinus. BASE of shell convex, devoid of any discernible striae but crossed by strong growth lines. COLOUR pinkish-white suffused with light brown; brown and white spots alternately on both ridges. OPERCULUM circular, approx. 1.6 mm diameter, dark brown, horny, outer side a little convex with raised central nucleus having a depressed centre, about 12 raised concentric lamellae, thin and papery; underside smooth, concave and gelatinous in appearance.

Type locality: Twofold Bay, New South Wales, 15 fathoms (27 metres).

Dimensions: Holotype, length 15 mm, breadth 5 mm, Australian Museum, Sydney, Reg'd. No. C.71638.

Turritellidae

Distribution: New South Wales, Victoria and Tasmania.

Material: Large quantity from four State Museums.

Discussion: This well marked small species can be readily distinguished from *C. (P.) quadrata* (Donald), which is rather similar in appearance, by its far shallower V-notch at the sutures, the lack of development of the posterior ridge compared with the well developed anterior ridge, whilst the centre of whorls is less concave than those of *C. (P.) quadrata*. This species has a strong general resemblance to the fossil *C. (C.) pagodula* (Tate), which is possibly ancestral. However the posterior cingulum in *C. (C.) pagodula*, if present at all, is far less pronounced, whilst the bifurcated lower cingulum does not imbricate over the lower whorl in the pronounced fashion of *C. (C.) guillaumei*.

FOSSIL SPECIES

Colpospira (Ctenocolpus) gemmulata (Tate, 1893)

Pl. 28, fig. 7.

1893 *Turritella gemmulata* Tate, *Trans. R. Soc. S. Aust.*, 17: 338, pl. 8, fig. 11.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ round dome-shaped whorls, nucleus a little submerged. TELEOCONCH 9 whorls, flatly concave, spire straight sided. SUTURES fairly deeply impressed. SCULPTURE of beaded cords, firstly at base of whorl, followed by another at top and then in centre; two or three others follow at intervals making five or six on body-whorl, next but one to lower suture usually the most prominent. APERTURE sub-circular; columella arcuate, inner lip slightly reflected; outer lip with typical sinus. BASE of shell flatly convex, about five fine threads crossed by numerous growth lines.

Type locality: Muddy Creek, west of Hamilton, Victoria. Lower beds. Muddy Creek Formation: Balcombian: Middle Miocene.

Dimensions: Holotype, length 6.5 mm, breadth 1.75 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T.1413 C, D.

Material: 4 topotypes National Museum of Victoria, Melbourne.

Discussion: This species bears a fairly strong resemblance to the unique specimen of the recent *Colpospira joannae* (Hedley), being almost identical in size and shape of whorls, but the strongly gemmate whorls of this species sets it apart from the crenulated ribbing of *C. joannae*.

Colpospira (Ctenocolpus) pagodula (Tate, 1893)

Pl. 30, fig. 4.

1893 *Turritella pagodula* Tate, *Trans. R. Soc. S. Aust.*, 17: 336, pl. 8, fig. 10.

1914 *Turritella pagodula*. Chapman and Gabriel, *Proc. R. Soc. Vict.*, 26: 323.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ round, dome-shaped whorls, nucleus a little submerged. TELEOCONCH 14 whorls, medially concave, spire straight sided. SUTURES well impressed within a shallow V-notch. SCULPTURE — a heavy cingulum at base of each whorl which frequently bifurcates in the more mature whorls, and occasionally a narrower cingulum at top, area between decidedly concave;

several very faint transverse threads in concave area in some specimens, crossed by numerous sinuate incremental striae. APERTURE sub-circular; columella strongly arcuate, inner lip reflected on to body-whorl and at base; outer lip a little thickened with typical sinus. BASE of shell convex with about ten indeterminate concentric striae crossed by numerous growth lines.

Type locality: Gippsland Lakes, Victoria. Jemmys Point Formation: Kalimnan: Upper Miocene/Lower Pliocene.

Dimensions: Holotype, length 12.5 mm, breadth 4.25 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T. 1421 D.

Material: 4 topotypes National Museum of Victoria, Melbourne.

Discussion: This species is quite possibly directly ancestral to the recent *C. (C.) guillaumei* (Iredale), and the more mature whorls are almost identical. However the earlier whorls of *C. (C.) guillaumei* are flatly convex, the concave appearance not commencing until about the sixth whorl, and it is also devoid of basal striations; other differences are very minor.

Genus GAZAMEDA Iredale, 1924

GAZAMEDA Iredale, 1924, *Proc. Linn. Soc. N.S.W.*, 49: 247. Type species by original designation *Turritella gunnii* Reeve.

Generic characteristics: Medium to large. Recent species mainly maculated or spotted with brown. Whorls flatly convex to concave, spire usually straight sided. Aperture sub-quadrate. Base flat to a little concave. Protoconch paucispiral, asymmetric, $1\frac{1}{2}$ to 2 convex whorls, expanding rapidly in size, nucleus raised and prominent (excepting *G. declivis* Adams and Reeve). Labial sinus proscocline, broad and moderately deep (Fig. 5). B is first primary spiral to emerge weakly, followed by a number of faint secondaries. Later spiral cords medium to strong.

Gazameda gunnii (Reeve, 1849)

Pl. 28, fig. 8-11.

- 1849 *Turritella gunnii* Reeve, *Conch. Icon.*, 5, pl. 9, fig. 45.
 1881 *Turritella philippensis* Watson, *Jour. Linn. Soc. Lond.*, Zool., 15: 223.
 1886 *Turritella philippensis*. Watson, *Rep. Sci. Res. Challenger*, Zool., 25: 479, pl. 30, fig. 6.
 1886 *Turritella gunnii*. Tryon, *Man. Conch.*, 8: 203, pl. 63, fig. 86.
 1924 *Gazameda gunnii*. Iredale, *Proc. Linn. Soc. N.S.W.*, 49: 247.
 1950 *Gazameda gunnii*. Allan, *Aust. Shells*, p. 92, text fig. 3.
 1957 *Gazameda gunnii*. Marwick, *Proc. Mal. Soc. Lond.*, 32: 154, fig. 52.
 1962 *Gazameda gunnii*. Macpherson and Gabriel, *Mar. Moll. Vict.*, p. 98, text fig. 123.

Description: PROTOCONCH asymmetric, of two whorls, flatly convex, expanding rapidly in diameter, nucleus erect and prominent. TELEOCONCH 18 whorls, flat, frequently contracted a little posteriorly, spire straight sided. SUTURES deeply incised. SCULPTURE very variable, a weak cingulum at base of whorls becoming heavier with maturity, from three to six striations above it, varying considerably in importance, often accompanied by several microscopic threads. APERTURE sub-quadrate; columella arcuate, inner lip a little reflected at base; outer lip thin with typical sinus. BASE of shell flat with a few rather vague concentric striae, crossed by very fine densely packed growth lines.

Turritellidae

COLOUR, apex translucent white, main whorls off-white with brown or purple-brown bands round centre of whorls, brown wavy flames, pale fawn on base. OPERCULUM circular, light horn colour, central nucleus and concentric growth ridges.

Type locality: Tasmania.

Dimensions: Holotype — Reeve's figured painting — length 56 mm, breadth 12.5 mm, British Museum (Natural History), Reg'd. No. 1969272.

Distribution: Tasmania, Victoria, New South Wales and southern Queensland, in depth from about 8 metres to at least 140 metres.

Material: Large quantities from six State Museums.

Discussion: A very variable species so far as sculpture of main whorls is concerned. Transverse cords vary from four to six, usually fairly strong, whilst many from Tasmania tend to be very faint, giving quite a smooth appearance. In some, especially from deeper water, the anterior cingulum is so strongly developed that it imbricates well over the succeeding whorl. Those from northern New South Wales and southern Queensland usually have four cords only, all equal and strongly developed and also brighter in colour than more southerly specimens. A series from off Merimbula, New South Wales, shows the anterior cingulum strongly developed and quite nodulose, whilst those from Disaster Bay, a little further south, are decidedly broader for their length.

Gazameda declivis (A. Adams and Reeve, 1848)

Pl. 28, fig. 12; Pl. 30, fig. 5.

- 1848 *Turritella declivis* A. Adams and Reeve, *Voy. Samarang*, Zool., p. 48, pl. 12, fig. 10.
 1849 *Turritella declivis*. Reeve, *Conch. Icon.*, 5, pl. 10, fig. 52.
 1886 *Turritella declivis*. Tryon, *Man. Conch.*, 8: 200, pl. 62, fig. 70.
 1907 *Turritella captiva* Hedley, *Proc. Linn. Soc. N.S.W.*, 32: 500, pl. 17, fig. 26.

Description: PROTOCONCH asymmetric, two convex whorls, expanding rapidly in diameter, nucleus varying from depressed to rather erect and prominent. TELEOCONCH 18 whorls, convex to commence, later flattening, becoming a little concave medially with maturity, spire straight sided. SUTURES lightly impressed. SCULPTURE — first six or seven whorls strongly centrally corded, becoming flattened with age; from about thirteenth whorl onwards a heavy cingulum develops at top of each whorl, followed by a concave space with two lirae, the lower decidedly stronger; this is followed by two heavy cords at base of each whorl with a fine thread between; all more mature whorls are crossed by densely packed fine sinuate lines of growth, following line of outer lip. APERTURE sub-quadrangle; columella arcuate, inner lip reflected at base; outer lip thin with typical sinus. BASE of shell concave, ten or twelve fine lirae crossed by fine growth lines. COLOUR off-white with small red-brown spots immediately below the suture, often commencing as early as third whorl, becoming increasingly larger on succeeding whorls, irregular in outline and extending vertically down the whorls. OPERCULUM from a 40 mm specimen is circular, 3.3 mm diameter, light brown, very thin and translucent, slightly depressed central nucleus, numerous fine concentric lamellate growth lines.

Type locality: China sea.

Dimensions: Painting of holotype, length 70 mm, breadth 18 mm, British Museum (Natural History) Reg'd. No. 1874.12.11.165.

Distribution: Recorded from Gillett Cay, off Masthead Island, North-west Island and north of Cape Moreton in southern Queensland. One specimen off Rottneest Island, one immature specimen off Cape Leeuwin, both Western Australia. Five immature specimens east of King Island, Bass Strait. This species was recorded from Bass Strait by Schmeltz (1874, *Mus. Godeff. Cat.*, 5, p. 197) but was succeeded by the name *T. subsquamosa* in italics, and may have been mis-identified. This cannot now be verified owing to the destruction of the Godeffroy collection in the Hamburg Museum in 1943.

Material: Holotype, several paratypes and a number of more mature specimens from Queensland (Hedley's *T. captiva*), all Australian Museum. Six specimens Bass Strait and Western Australia, Australian Museum. One specimen Western Australia, in Western Australian Museum.

Discussion: The order in which the upper and lower cords on this species come into prominence is somewhat variable, especially in Queensland specimens (*T. captiva* Hedley). The primary spire whorls, also labial and basal sinuses from all localities where found so far in Australian waters, agree well with the type for the genus, *G. gunnii* Reeve. However the protoconch shows remarkable differences, that on all Queensland specimens examined, although expanding rapidly in the usual manner for the genus, has the nucleus almost totally submerged. The two specimens from off Rottneest Island and Cape Leeuwin in Western Australia unfortunately have the protoconch missing, but the five immature specimens from off King Island, Bass Strait, show remarkable differences for shells from the same locality. A typical protoconch for Queensland specimens is shown at Fig. 15 in the Introduction, whilst three of the Bass Strait specimens are shown at Fig. 16-18. This is the only species in all those included in this paper where the protoconch has failed as one of the guides to generic determination. The Queensland specimens grow to a far larger size than any noted by Hedley, the largest examined so far from North-east of Cape Moreton would have measured approx. 60 mm in length with 19 whorls if complete.

Gazameda iredalei Finlay, 1927

Pl. 28, fig. 13.

- 1873 *Turritella clathrata* Kiener and Fischer, *Coq. Viv.*, 139-40: 38, pl. 14, fig. 4.
 1886 *Turritella clathrata*. Tryon, *Man. Conch.*, 8: 206, pl. 64, figs. 2, 16.
 1927 *Gazameda iredalei* Finlay, *Trans. New Zeal. Inst.*, 57: 496 (New name for *T. clathrata* Kiener, 1873, non Deshayes, 1833).
 1931 *Stiracolpus iredalei*. Cotton and Godfrey, *S. Aust. Naturalist*, 12: 59, pl. 2, fig. 4.
 1950 *Gazameda iredalei*. Allan, *Aust. Shells*, p. 92, text fig. 1.
 1962 *Gazameda iredalei*. Macpherson and Gabriel, *Mar. Moll. Vict.*, p. 98, text fig. 124.

Description: PROTOCONCH asymmetric, of two flatly convex whorls, expanding rapidly in diameter, nucleus erect and prominent. TELEOCONCH 18 whorls, each with two concave sections, spire slightly concave. SUTURES lightly impressed in early whorls, overshadowed by lower keel in later whorls and difficult to detect. SCULPTURE of one strong keel from first whorl onwards, developing into a prominent central keel, followed by a second prominent keel from about fifth whorl, situated at

Turritellidae

base of whorls and overshadowing the lower suture; five to seven fine transverse striations develop in later whorls both above and below central keel, crossed by very fine densely packed growth lines, causing a roughened and slightly punctate appearance. APERTURE sub-quadrate; columella arcuate, inner lip strongly reflected on to body-whorl at maturity; outer lip thin with typical sinus. BASE of shell flat, devoid of striae and crossed by extremely fine sinuous growth lines. COLOUR of primary whorls off-white, other whorls purple-brown between the keels, which remain whitish with brown spots. OPERCULUM simple, circular, dark brown, central slightly raised nucleus and concentric growth rings.

Type locality: South Australia.

Dimensions: Kiener's holotype, length 48 mm, believed to be held by Museum d'Histoire Naturelle, Paris, Reg'd. No. not available.

Distribution: South coast of Western Australia, South Australia, Victoria and Tasmania.

Material: Large quantity from four State Museums.

Discussion: The species appears to live in fairly shallow to medium depths, being washed up on beaches in fair quantity but difficult to obtain alive. The shell has the appearance of a sharply tapered wood-screw, and its two bold sharp ridges on each whorl separate it without difficulty from any other species, either recent or fossil.

Gazameda tasmanica (Reeve, 1849)

Pl. 28, fig. 14.

- 1849 *Turritella tasmanica* Reeve, *Conch. Icon.*, 5, pl. 9, fig. 42.
 1871 *Turritella subsquamosa* Dunker, *Mal. Blätt.*, 18: 152.
 1876 *Turritella acuta* Tenison-Woods, *Pap. Proc. R. Soc. Tas.*, (1875), p. 143.
 1881 *Turritella lamellosa* Watson, *Jour. Linn. Soc. Lond., Zool.*, 15: 229.
 1886 *Turritella lamellosa*. Watson, *Rep. Sci. Res. Challenger, Zool.*, 25: 474, pl. 29, fig. 6.
 1886 *Turritella tasmanica*. Tryon, *Man. Conch.*, 8: 203, pl. 63, fig. 87.
 1897 *Turritella oxyacris* Tate, *Trans. R. Soc. S. Aust.*, 21: 41 (new name for *T. acuta* Tenison-Woods, 1876, non Mayer, 1859).
 1924 *Turritella subsquamosa*. Iredale, *Proc. Linn. Soc. N.S.W.*, 49: 250.
 1931 *Gazameda tasmanica*. Cotton and Godfrey, *S. Aust., Naturalist*, 12: 57.
 1962 *Gazameda subsquamosa*. Macpherson and Gabriel, *Mar. Moll. Vict.*, p. 98, text fig. 125.

Description: PROTOCONCH asymmetric, of two whorls, flatly convex, expanding rapidly in diameter, nucleus rather erect and prominent. TELEOCONCH 15 whorls, first six or seven a little convex, remainder flat; sides of spire straight. SUTURES moderately impressed. SCULPTURE — primary whorls centrally corded, becoming flattened and joined by numerous striations of varying importance with finer threads between, and with cingula developing at top and bottom of each whorl from about the sixth onwards; lower cingulum the stronger and frequently imbricates over lower suture. APERTURE sub-quadrate; columella arcuate, inner lip strongly reflected on to body-whorl and a little at base; outer lip thin with typical sinus. BASE of shell flat with numerous fine concentric striations crossed by densely packed fine growth lines. COLOUR of protoconch and first three or four primary whorls translucent white, usually a wide purple-brown band round centre of all other whorls, brown spots on cingula and brown wavy axial flames crossing the colour band; some specimens very pale with brown spots only. OPERCULUM is similar in all respects to that of *G. gunnii* (Reeve).

Type Locality: Tasmania.

Dimensions: Holotype — Reeve's figure — length 42 mm, breadth 9.5 mm, British Museum (Natural History), Reg'd. No. 1969269.

Distribution: South-western Western Australia to South Australia, Tasmania, Victoria, New South Wales and southern Queensland, in depths from about 8 metres to 90 metres.

Material: Large quantity from six State Museums.

Discussion: It is unfortunate that Reeve chose to name this species from one old worn and colourless specimen, which led to the subsequent naming of several synonyms by other workers. In his description the words "ridged at the lower edge, encircled with two ridges with intermediate striae above" are somewhat misleading, as the two main ridges or cingula occur at top and bottom of each whorl with the intermediate striations between. Worn, immature or broken specimens are frequently difficult to separate from *G. gunnii* Reeve, but a good mature specimen is fairly easily separated by the flatter appearance of the whorls, the more numerous and regular striations, and chiefly by the finely punctate appearance of the whorls due to crossing of the striations by numerous and densely packed growth lines.

FOSSIL SPECIES

Gazameda acricula (Tate, 1893)

Pl. 28, fig. 15.

1893 *Turritella acricula* Tate, *Trans. R. Soc. S. Aust.*, 17: 339.

1935 *Turritella (Gazameda) acricula*. Cotton and Woods, *Rec. S. Aust. Mus.*, 3: 373.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ smooth globose whorls, nucleus erect and prominent. TELEOCONCH 18 whorls, first four convexly ridged medially, balance a little concave; spire straight sided. SUTURES strongly incised. SCULPTURE — a strong median keel on all whorls, a heavy cingulum at base, sometimes a finer cingulum at top, with several striations developing above and below the central keel after about sixth whorl; lower cingulum expands and imbricates over whorl below from about tenth onwards. APERTURE sub-quadrate; columella straight, inner lip slightly reflected at base; outer lip thin with typical sinus. BASE of shell flat with numerous concentric striae of varying strength crossed by fine growth lines.

Type locality: River Murray cliffs, South Australia. (Actual locality has been determined as four miles downstream from Morgan, South Australia, on left bank of River Murray). Cadell Marl Lens of Morgan Limestone: Batesfordian: Lower Miocene.

Dimensions: Holotype, length 38 mm, breadth 6.25 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T.1410 C.

Material: Six topotypes National Museum of Victoria, Melbourne. Numerous topotypes Australian Museum, Sydney.

Discussion: The placing of this species in the genus *Gazameda* is to a certain extent a matter of expediency, but it is the closest available.

Turritellidae

The recognition points agree reasonably well with the main exception of the protoconch. This shows a slight divergence in some specimens from the common somewhat turbinate protoconch with a large globose nucleus, towards the unusual slightly scaphelloid protoconch of the recent *G. gunnii* (Reeve), and may well represent the early beginnings of the *Gazameda* protoconch as we know it to-day. This earlier form of protoconch however, is decidedly narrower at the base than that of the recent species. The protoconchs of some recent species tend to show intraspecific differences in specimens taken from the same locality (see Figures 16-18 at end of Introduction — *Gazameda declivis* (Adams and Reeve)).

Gazameda victoriensis victoriensis (Cotton and Woods, 1935)

Pl. 28, fig. 16.

1893 *Turritella acricula* var. Tate, *Trans. R. Soc. S. Aust.*, 17: 340, pl. 9, figs. 4, 4a.1935 *Turritella (Gazameda) acricula victoriensis*. Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 374, 376. Not figured.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ smooth globose whorls, expanding rapidly, nucleus erect and prominent. TELEOCONCH 11 whorls, first three medially angulate, balance a little convex, spire slightly convex. SUTURES deeply impressed first four whorls, then a little canaliculate. SCULPTURE — a basal cingulum forms from fourth or fifth whorl, together with numerous striations, increasing in number on mature whorls; cingulum tends to imbricate over lower whorls from about seventh onwards; numerous incremental striae visible on mature whorls. APERTURE sub-quadrate; columella fairly straight, inner lip reflected at base; outer lip thin with typical sinus. BASE of shell flat, bordered by a strong peripheral ridge with fairly deep groove adjoining, then several indefinite concentric striae crossed by irregular growth lines.

Type locality: Gellibrand River, Victoria. (Cliffs 2-3 miles north-west of mouth of Gellibrand River). Gellibrand Marl: Balcombian: Middle Miocene. (Specimens from type locality at National Museum of Victoria are of Balcombian age, and it appears unlikely that this species ranges into the Bairnsdalian on the Gellibrand Coast — T. A. Darragh, pers. comm.)

Dimensions: Holotype, length 25 mm, breadth 5.5 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T.1411 E.

Material: 5 topotypes National Museum of Victoria, Melbourne.

Discussion: Similar remarks apply in the case of this species to those under *G. acricula* (Tate), especially with regard to the protoconch, also the general formation of the neanic and mature whorls sets it quite apart from *G. acricula* and it is accorded full specific rank.

Gazameda victoriensis manyung subsp. nov.

Pl. 28, fig. 17.

Description: PROTOCONCH paucispiral, asymmetric, $1\frac{1}{2}$ smooth globose whorls, expanding rapidly, nucleus erect. TELEOCONCH 12 whorls, first three convex and strongly sub-centrally unicarinate; balance less convex, smooth and imbricating at base over whorl below; spire straight sided. SUTURES strongly incised first five or six whorls, later becoming

strongly canaliculate. SCULPTURE — after subsidence of sub-central carination on about fourth whorl, microscopic finely punctate lines gradually appear, increasing to about 18 on last whorl, intervening spaces flat and smooth; a basal cingulum develops on all whorls after about fourth whorl, becoming more pronounced and imbricating strongly over whorl below; growth striations fairly numerous and prominent under magnification on all mature whorls. APERTURE sub-quadrate; columella arcuate, inner lip strongly reflected at base; outer lip thin with broad and deep medial sinus, typical of the genus. BASE of shell a little concave with up to ten microscopic finely punctate concentric lines, crossed by numerous growth striae.

Type locality: Cliff-face south of Manyung Rocks, Mornington Peninsula, Victoria; Bed 10B a of Gostin, 1966, Grid. Ref. Cranbourne 106903. Upper Balcombe Clay: Bairnsdalian: Middle Miocene.

Dimensions: Holotype, length 19.2 mm, breadth 4.9 mm, National Museum of Victoria, Reg'd. No. P.27457. Largest paratype, length 23.8 mm, breadth 5.9 mm.

Material: Holotype as above, 30 paratypes Australian Museum, Sydney.

Discussion: This subspecies differs from the nominal subspecies *G. v. victoriensis* chiefly by the perfectly flat interspaces between the finely punctate lines on all whorls, as compared with the flatly rounded striations between the punctate lines on *G. v. victoriensis*. In addition the canaliculate sutures on this subspecies commence earlier and are far more pronounced.

Gazameda adelaidensis (Cotton and Woods, 1935).

Pl. 28, fig. 18.

1935 *Turritella* (*Gazameda*) *acricula adelaidensis* Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 374, 376, text fig. 2, p. 371.

1952 *Gazameda adelaidensis*. Cotton, *Geol. Surv. S. Aust.*, Bull. 27, Append. 4: 245.

1954 *Turritella* (*Haustator*) *acricula adelaidensis*. Ludbrook, *Trans. R. Soc. S. Aust.*, 77: 59.

1957 *Turritella* (*Gazameda*) *acricula adelaidensis*. Ludbrook, *Trans. R. Soc. S. Aust.*, 80: 17.

Description: PROTOCONCH asymmetric, of two flatly convex whorls, expanding rapidly in diameter, nucleus erect and prominent. TELEOCONCH 15 whorls, first four strongly medially ridged, balance flatly convex, spire slightly convex. SUTURES strongly impressed for first seven whorls, then progressively more excavate, imbricating over lower whorls. SCULPTURE consists of strong medial cord for first four whorls, the cord then becoming a strong keel and persisting to body-whorl; a basal cingulum develops about fourth whorl, accentuating the degree of imbrication over lower whorls; three or four strong striations commence about fourth whorl both above and below central keel, increasing to as many as twelve, crossed by dense and prominent sinuous growth lines, giving a latticed appearance to shell. APERTURE sub-quadrate; columella straight, inner lip slightly reflected at base; outer lip thin with typical sinus. BASE of shell flat with heavy peripheral ridge, a deep groove adjoining, several fine concentric striae crossed by dense growth lines, giving a latticed appearance similar to whorls.

Type locality: Abattoirs Bore, Adelaide, South Australia, 300-500 feet. Dry Creek Sands: Yatalan: Upper Pliocene.

Dimensions: Holotype, length 37 mm, breadth 7 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T. 1681.

Turritellidae

Material: 4 topotypes National Museum of Victoria, Melbourne.

Discussion: The protoconch of this species approaches more closely the typical *Gazameda* protoconch of the type species, the recent *G. gunnii* Reeve, than does that of *G. acricula* Tate, and even though it exhibits the strong central keel of *G. acricula*, owing to the differences in protoconch and sculpture, it cannot be regarded as a subspecies and is therefore accorded full specific rank.

Gazameda subacricula (Cotton and Woods, 1935)

Pl. 29, fig. 1.

- 1935 *Turritella* (*Gazameda*) *subacricula* Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 376, text fig. 3, p. 371.
 1952 *Gazameda subacricula*. Cotton, *Geol. Surv. S. Aust.*, Bull. 27, append. 4: 245.
 1954 *Turritella* (*Haustator*) *subacricula*. Ludbrook, *Trans. R. Soc. S. Aust.*, 77: 59.
 1957 *Turritella* (*Gazameda*) *subacricula*. Ludbrook, *Trans. R. Soc. S. Aust.*, 80: 18.

Description: PROTOCONCH paucispiral, asymmetric, $1\frac{1}{2}$ smooth globose whorls, nucleus erect and prominent. TELEOCONCH 14 whorls, first two convexly centrally keeled, remainder flatly convex, spire straight sided. SUTURES finely but strongly incised. SCULPTURE — median keel on first two whorls which continues in subdued form throughout; a bifurcated basal cingulum commences on third whorl; two further keels above central keel commence on fourth whorl, often with a finer striation between them from about tenth whorl onwards; densely packed growth striae become progressively stronger, giving a pitted appearance generally. APERTURE sub-quadrate; columella straight, inner lip reflected at base; outer lip thin with typical sinus. BASE of shell flatly concave, heavy peripheral ridge, about 8 concentric lirae crossed by coarse densely packed growth lines.

Type locality: Abattoirs Bore, Adelaide, South Australia, 300-500 feet. Dry Creek Sands: Yatalan: Upper Pliocene.

Dimensions: Holotype, length 40.5 mm, breadth 7.8 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T.1686.

Material: 4 topotypes National Museum of Victoria, Melbourne.

Discussion: This species is the same age and from the same type locality as *G. adelaidensis*, but the fairly substantial differences in the two warrant separation. The whorls of this species are flatter than those of *G. adelaidensis*, they do not show the same strong imbricating tendency in the lower part of the whorls, and the spiral striations are decidedly coarser. No intermediate specimens have been found in any of the material examined and it is considered that the two species are distinct.

Genus HAUSTATOR Montfort, 1810

HAUSTATOR Montfort, 1810, *Conchyl. Syst.*, 2: 183. Type species by subsequent designation *Turritella imbricataria* Lamarck. (Guillaume, 1925, *Bull. Soc. Geol. France*, (4), 24: 290).

Subgenus KUROSIONA Ida, 1952

KUROSIONA Ida, 1952, *Geol. Surv. Japan*, Rep. 150: 43. Type species by original designation *Turritella kurosio* Ida.

Subgeneric characteristics: Small to medium, thin, light in weight. Whorls flatly convex, spire straight sided. Aperture sub-circular. Base

flatly convex. Protoconch of three minute flatly globose whorls, nucleus unavailable. Labial sinus a little prosocline, fairly deep and moderately broad (Fig.6). Primary spirals emerge in order C, B, A. Spiral cords rather weak, some nodulose.

Haustator (Kurosoioia) cingulifer (Sowerby, 1825)

Pl. 29, fig. 2-3.

- 1825 *Turritella cingulifera* Sowerby, *Cat. Tankerville*, Append., p. 14, no. 1442.
 1830 *Turritella fascialis* Menke, *Synop. Meth. Moll.*, p. 83, ed. 2, (1828), p. 45, no. 138.
 1832 *Turritella tricarinata* King, *Zool. Journ.*, 5: 346, no. 55.
 1843 *Turritella tricarinata*. Deshayes, *Hist. Anim. s. Vert.*, 9: 262, sp. 20.
 1848 *Turritella bicolor* A. Adams and Reeve, *Voy. Samarang*, *Zool.*, p. 47, pl. 12, fig. 1.
 1849 *Turritella fascialis*. Reeve, *Conch. Icon.*, 5, pl. 10, fig. 47; *ibid.* *T. cingulifera* Sowerby, pl. 11, fig. 64.
 1853 *Turritella fusco-tincta* Pettit, *J. Conch. Paris*, 4: 368, pl. 11, fig. 3.
 1861 *Turritella gracillima* Gould, *Proc. Boston Soc. Nat. Hist.*, 7: 386.
 1862 *Turritella gracillima*. Gould, *Otia Conch.*, p. 140.
 1873 *Turritella fragilis* Kiener, *Coq. Viv.*, 9: 34, pl. 8, fig. 3.
 1875 *Turritella fascialis*. E. A. Smith, *Japan Gasteropoda*, p. 19, no. 69.
 1877 *Turritella parva* Angas, *Proc. Zool. Soc. Lond.*, p. 174, pl. 26, fig. 17.
 1878 *Turritella cingulifera*. Brazier, *Proc. Linn. Soc. N.S.W.*, 12: 1, no. 1.
 1886 *Turritella fascialis*. Watson, *Rep. Sci. Res. Challenger*, *Zool.*, 25: 468.
 1886 *Turritella cingulifera*. Tryon, *Man. Conch.*, 8: 193, pl. 59, figs. 38-41; *ibid.*, *T. fascialis*, p. 197, pl. 59, figs. 36-37.
 1897 *Turritella fascialis*. Kobelt, *Conch. Cab.*, Bd. 1, Abt. 27, sp. 12 - 13; Taf. 4, Abt. 5.
 1938 *Turritella fascialis*. Otuka, *Jap. Journ. Mal.* 8: 38, text fig. 5.
 1941 *Turritella fascialis*. Merriam, *Univ. Cal. Bull.*, *Geol. Sc.* 26: 16.
 1952 *Kurosoioia fascialis*. Ida, *Geol. Surv. Japan, Rep.*, 150: 45, pl. 1, fig. 11; *ibid.*, *K. fascialis gracillima*. Pp. 46 - 47, pl. 1, fig. 10.
 1959 *Kurosoioia fascialis*. Kotaka, *Sci. Rep. Tohoku Univ.*, (2), 31: 86.

Description: PROTOCONCH mamillate, of three minute flatly globose whorls, 0.2 mm diameter, nucleus unavailable. TELEOCONCH 18 whorls, flatly convex, sides of spire straight. SUTURES moderately impressed. SCULPTURE — a primary spiral cord appears towards base of first whorl, closely followed by another centrally, then another towards top of whorls; as early as sixth whorl other fine spirals may appear, some increasing in importance, some crenulated and some smooth, and body-whorl may carry as many as 18. APERTURE almost circular, a little higher than wide, columella straight and very thin, inner lip not reflected; outer lip thin and fragile, with typical sinus. BASE of shell a little convex, with numerous uneven fine spirals crossed by very fine lines of growth. COLOUR off-white or cream to light brown; a deep chestnut band above, below or on both sides of sutures; base often has sinuate chestnut bands. OPERCULUM circular, light brown, central nucleus, surface dull and somewhat rough, about seven concentric lamellations, thickening towards centre, soft and gelatinous in appearance.

Type locality: East Indies. (Indonesia).

Dimensions: Specimens may measure up to 25 mm in length and 5 mm in breadth; average specimen at maturity 21 mm in length, 4.5 mm in breadth. I have been unable to trace the whereabouts of the holotype from the Tankerville collection.

Distribution: In Australia across the whole of the northern coastline, southwards along west coast at least as far as Onslow, southwards along east coast at least as far as Port Jackson, New South Wales.

Turritellidae

Material: Large quantity from six State Museums.

Discussion: Both the species *H. (K.) cingulifer* (Sowerby) and *H. (K.) fascialis* (Menke) were shown by Hedley (1909: 357-8) as living in Queensland, also Kuroda and Habe (1952: 95-6) show both species living in Japan, possibly through traditional usage, as no serious attempt appears to have been made to decide whether in fact two distinct species exist. The type locality of *H. (K.) fascialis* is unknown, the type specimen unknown, and as far as can be seen no good basis exists for retention of the name. Reeve, on the authority of Cuming, gave a Central American locality as the type locality, which has proved to be erroneous. The original descriptions were rather similar, no important details were given, and in view of present knowledge the descriptions were totally inadequate. When the variability in length, width, sculpture and height of whorls is taken into account, the impressive synonymy is understandable. The species is washed up on Queensland beaches in huge drifts, one of which I estimated to contain 1,200 cubic feet of shells, and a very wide range of form, colour and sculpture is exhibited. The minute three-whorled protoconch calcifies and disintegrates in stages as it is vacated by the mollusc, exposing an internal septum. This can quite easily be mistaken for the protoconch nucleus if the fractured edges become worn and it is not viewed under sufficiently high power. This has possibly misled some workers in the past into believing that several styles of protoconch are involved, indicating more than one species when coupled with the great variation in sculpture.

I have shown both *H. (K.) fascialis* and *H. (K.) gracillima* as synonyms of *H. (K.) cingulifer*, although Ida (1952: 46) gives reasons for considering *H. (K.) gracillima* a good subspecies of *H. (K.) fascialis* (= *cingulifer*). However examination of a number of specimens from various parts of Japan, Philippine Islands and Papua-New Guinea shows them all to fall within the range of variation exhibited by the one species from such a large area of the Australian coastline.

Haustator (Kurosoia) leeuwinensis sp. nov.

Pl. 29, fig. 6.

Description: PROTOCONCH — last $2\frac{1}{2}$ whorls of protoconch remaining on 3 specimens are microscopic and flatly globose, nucleus unknown. TELEOCONCH eleven whorls, possibly immature, all roundly convex; spire straight sided. SUTURES faintly impressed. SCULPTURE of one strong cord on first whorl, immediately below centre, gradually fading until only a faint striation about fourth whorl, accompanied by a further four above and four below; main whorls otherwise smooth except for faint growth striae conforming to outer lip. APERTURE sub-quadrate; columella slightly arcuate, inner lip a little reflected at base; outer lip thin with typical medial sinus. BASE of shell flat with faint growth lines only. COLOUR of top half of each whorl a faint yellow, lower half chestnut, commencing gradually and becoming darker with each succeeding whorl; the two bands of colour are divided by a fine brown line in centre of each whorl; a fine hair-line of brown just visible on top of each fine striation in lower colour band. OPERCULUM unknown.

Type locality: West of Jurien Bay, Western Australia, 142 metres.

Dimensions: Holotype, length 9 mm, breadth 2.7 mm, Australian Museum, Sydney, Reg'd. No. C.72592. Six paratypes from type locality.

Distribution: Localities recorded other than type locality are: 156 metres west of Bunbury, W.A. (3 specimens); 77-144 metres south of Cape Leeuwin, W.A. (1 specimen), both lots Australian Museum, Sydney; 128-132 metres west of Dongara, W.A. (2 specimens), 109 metres west of Rottneest Is. (11 specimens), Western Australian Museum.

Material: 24 specimens as above.

Discussion: Although 11 specimens of this new species are held by the Australian Museum, Sydney, from dredgings taken by H.M.A.S. "Gascoigne" in 1962, and 13 by the Western Australian Museum, none are mature. The holotype has nine main whorls and one paratype 11 whorls, and it could grow to a decidedly larger shell; it is quite distinct from any other Australian species.

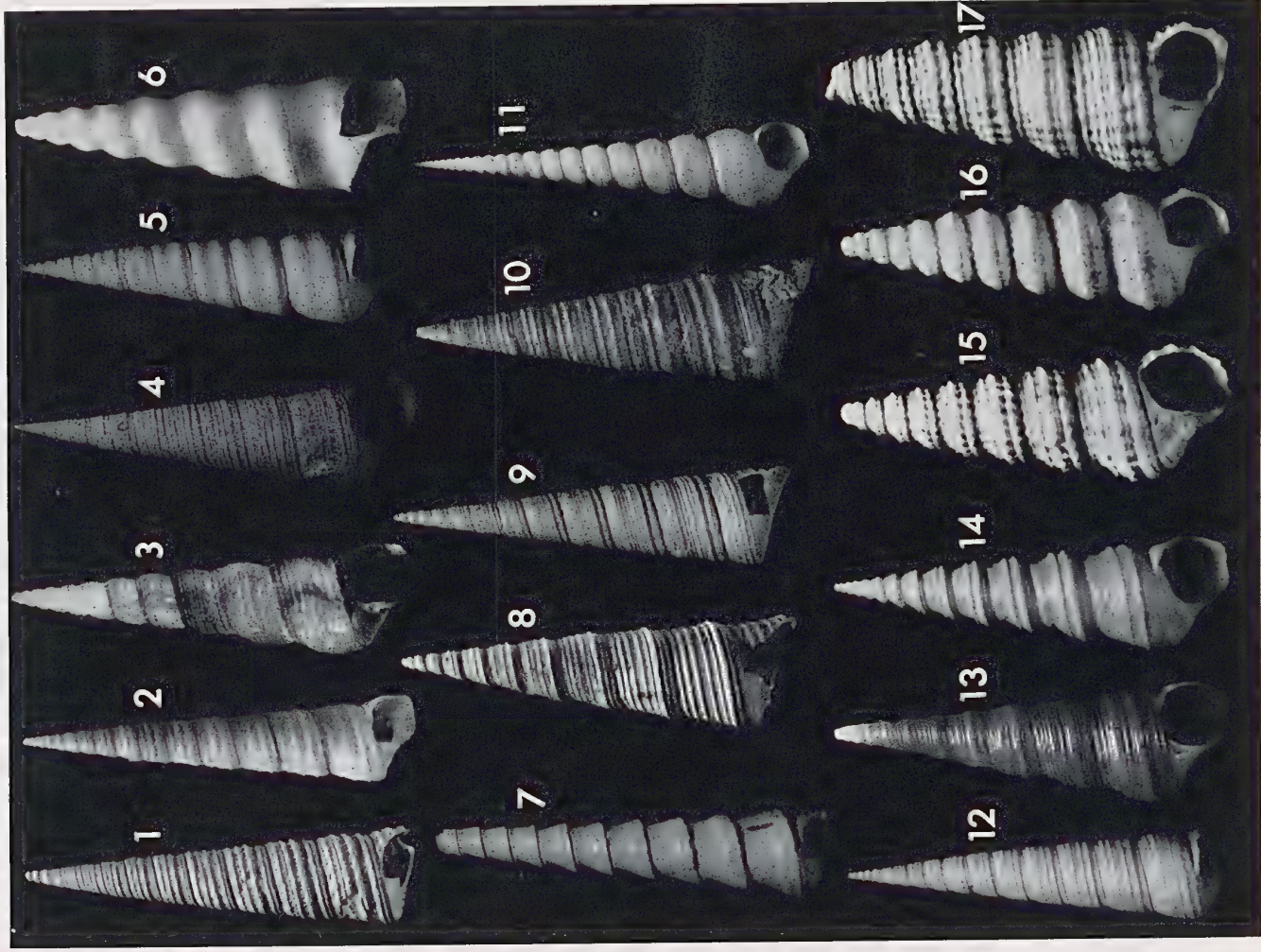
Genus MAORICOLPUS Finlay, 1927

MAORICOLPUS Finlay, 1927, *Trans. New Zeal. Inst.*, 57: 389. Type species by original designation *Turritella rosea* Quoy and Gaimard.

Generic characteristics: Small to very large. Whorls initially convex then flatly concave, spire straight sided. Aperture sub-quadrate. Base flat to slightly concave. Protoconch of three or four microscopic flatly globose whorls. Labial sinus prosocline, broad and moderately deep (Fig. 7). Primary spirals emerge in order B, C, A. Spiral cords fine to strong.

PLATE 29

1. *Gazameda subacricula* (Cotton and Woods). Abattoirs Bore, Adelaide, South Australia. Topotype, X 2.5. N.M.V. No. P26990.
2. *Haustator (Kurosiola) cingulifer* (Sowerby). Lindeman Island, Queensland. Figured specimen, X 2.6. A.M. No. C77377.
3. *Haustator (Kurosiola) cingulifer* (Sowerby). Off Yeppoon, Queensland, 4 metres. Figured specimen, X 4.1. A.M. No. C58408.
4. *Maoricolpus roseus* (Quoy and Gaimard). Porto Bello Beach, New Zealand. Figured specimen, X 1. A.M. No. C43889.
5. *Maoricolpus murrayanus* (Tate). Murray River cliffs, 4 miles south of Morgan, South Australia. Topotype, X 1.3. A.M. No. C77390.
6. *Haustator (Kurosiola) leeuwinensis* Garrard. West of Jurien Bay, Western Australia, 142 metres. Holotype, X 7. A.M. No. C72592.
7. *Maoricolpus septifragus* (Tate). Zone 4, above ledge, Bird Rock Cliffs, Torquay, Victoria. Topotype, X 0.9. N.M.V. No. P27001.
8. *Maoricolpus tasmaniensis* (Cotton and Woods). Fossil Bluff, Table Cape, near Wynyard, Tasmania. Topotype, X 2.4. N.M.V. No. P27008.
9. *Maoricolpus roseus subrudis* (Cotton and Woods). Abattoirs Bore, Adelaide, South Australia. Topotype, X 1.7. N.M.V. No. P26989.
10. *Spirocolpus aldingae* (Tate). Blanche Point, Aldinga Bay, South Australia. Figured specimen, X 2.2. N.M.V. No. P26999.
11. *Turritella terebra* (Linnaeus). Cape York Peninsula, Queensland. Figured specimen, X .65. A.M. No. C77368.
12. *Zeacolpus (Zeacolpus) vittatus* (Hutton). Lower beds, Castlecliff, New Zealand. Figured specimen, X 1.2. A.M. No. C77375.
13. *Zeacolpus (Stiracolpus) capricornius* Garrard. Dundowron Beach, north of Hervey Bay, Queensland. Holotype, X 4.4. A.M. No. C72584.
14. *Zaria duplicata* (Linnaeus). Colombo Harbour, Ceylon. Figured specimen, X .59. A.M. No. C52564.
15. *Glyptozaria opulenta* (Hedley). Off Port Jackson, New South Wales, 91 metres. Figured specimen, X 10. A.M. No. C77386.
16. *Glyptozaria columnaria* Cotton and Woods. Off Cape Pillar, southern Tasmania, 183 metres. Holotype, X 14.4. S.A.M. No. D11438.
17. *Glyptozaria transenna* (Tenison-Woods). Clifton Bank, Muddy Creek, west of Hamilton, Victoria. (Lower beds). Topotype, X 10. N.M.V. No. P26987.



Maoricolpus roseus (Quoy and Gaimard, 1834)

Pl. 29, fig. 4.

- 1834 *Turritella rosea* Quoy and Gaimard, *Voy. Astrolabe*, p. 136, pl. 55, figs. 24-26.
 1843 *Turritella rosea*. Deshayes, *Hist. Anim. s. Vert.*, 9: 260, sp. 16.
 1849 *Turritella rosea*. Reeve, *Conch. Icon.*, 5, pl. 8, sp. 41.
 1873 *Turriteila rosea*. Kiener, *Coq. Viv.*, 9: 32, sp. 25; pl. 12, fig. 2.
 1873 *Turritella rosea*. Hutton, *Cat. Mar. Moll. New Zeal.*, p. 29, no. 119.
 1873 *Turritella rosea*. Martens, *Crit. List Moll. New Zeal.*, p. 27.
 1880 *Turritella rosea*. Hutton, *Man. New Zeal. Moll.*, p. 83.
 1886 *Turritella rosea*. Tryon, *Man. Conch.*, 8: 199, pl. 62, figs. 67, 68; pl. 61, fig. 59.
 1927 *Maoricolpus roseus*. Finlay, *Trans. New Zeal. Inst.*, 57: 389.
 1965 *Maoricolpus roseus*. Greenhill, *Pap. Proc. R. Soc. Tas.*, 99: 67-8.

Description: PROTOCONCH multispiral, three to four microscopic flatly globose whorls, apparently sinusigeroid, nucleus not observed. TELEOCONCH 18 whorls, biangulate with slightly concave centre; spire straight sided. SUTURES fine but deeply incised. SCULPTURE of three strong cords on early whorls, central first to emerge, closely followed by lower, and upper cord emerges on about fourth whorl; central cord gradually subsides, upper remains prominent, lower cord dominates throughout after about seventh whorl; numerous fine and coarse striations develop at intervals, often up to 25 on penultimate whorl. APERTURE sub-circular, higher than wide; columella straight, inner lip reflected on to body-whorl as glazed callus; outer lip thin with typical sinus. BASE of shell flat with numerous strong striae crossed by numerous growth lines. COLOUR light creamy-pink, striae reddish-brown, often with wavy longitudinal flames. OPERCULUM circular, thin, central nucleus, reddish-brown, multi-lamellate, flat in centre, raised glossy red outer edge.

Type locality: New Zealand.

Dimensions: Holotype, length 2 pouces 3 lignes (60.75 mm), breadth 8 lignes (18 mm). Information not available, but probably in Museum d'Histoire Naturelle, Paris.

Distribution: New Zealand generally; southern and western Tasmania, 4-18 metres; southern Queensland, 110-150 metres.

Material: Large quantity from Australian Museum, Sydney; National Museum of Victoria, Melbourne; Tasmanian Museum, Hobart.

Discussion: Sculpture of this species is very variable, and the apical angle varies considerably, however the protoconch and sculpture of the neanic whorls are both quite constant. It is common and widespread throughout New Zealand, where it has a long history dating well back into the Tertiary. It would appear that it has only arrived in Australia, but possibly for the second time, during the past 40 years, and is now abundant in southern Tasmania, but was not recorded by May (1921: 60-61 and 1923: 60-61). Two dead specimens are also on record from Macquarie Harbour on the west coast of Tasmania. During the past five years a number of dead specimens have also been trawled north of Cape Moreton in southern Queensland, in depths down to 150 metres. The multispiral protoconch, indicating a long pelagic existence in the veliger stage, could account for possible transport of the species in the bilge or ballast water of ships, but not by the trans-Tasman currents, which all flow from west to east.

Turritellidae

The possibility is strong that during the Tertiary era this species formerly existed in Australia in the form now known as *M. murrayanus* (Tate), but apparently died out during the Miocene epoch (see further notes under latter species).

FOSSIL SPECIES

Maoricolpus septifragus (Tate, 1893)

Pl. 29, fig. 7.

1893 *Turritella septifraga* Tate, *Trans. R. Soc. S. Aust.*, 17: 336, pl. 8, fig. 5.

Description: PROTOCONCH unknown. TELEOCONCH at least 18 whorls, first few flat or slightly concave, all later whorls concave, imbricating over lower suture; spire concave. SUTURES well impressed in early whorls, in later whorls canaliculate. SCULPTURE consists of a slight cord on all whorls towards the base, a flatly rounded cingulum at top, usually developing on more mature whorls, two or three fine striae between lower cord and suture; concave area above lower cord has a few faint and distant striae. APERTURE sub-quadrate; columella slightly arcuate, outer lip with typical sinus. BASE of shell flat with several vague and indefinite striae crossed by numerous strong growth lines, which are also very pronounced on all whorls.

Type locality: Bird-rock Bluff, near Geelong, Victoria. Jan-Juc Formation: Janjukian: Upper Oligocene.

Dimensions: Holotype, length (incomplete) 100 mm, breadth 17 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T.1409 A.

Material: Two topotypes from National Museum of Victoria.

Discussion: This very large heavy species can be recognised on sight by its almost smooth concave whorls with a cingulum towards the base, and the pagoda-like effect of the imbricating base of each whorl. Although the protoconch is unknown, the size of the shell in conjunction with the labial and basal sinus and the general whorl shape place it in the genus *Maoricolpus*. It has no affinities with other fossil or recent species in Australia.

Maoricolpus murrayanus (Tate, 1885)

Pl. 29, fig. 5.

1885 *Torcula murrayana* Tate, *Pap. Proc. R. Soc. Tas.*, (1884), p. 227.1893 *Turritella murrayana*. Tate, *Trans. R. Soc. S. Aust.*, 17: 340, pl. 8, fig. 3.1896 *Turritella murrayana*. Pritchard, *Proc. R. Soc. Vict.*, 8: 113 - 4.1935 *Turritella (Maoricolpus) latissima* Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 372, text fig. 6, p. 377.

Description: PROTOCONCH multispiral, three to four microscopic flatly globose whorls, apparently sinusigeroid, nucleus not observed. TELEOCONCH 18 whorls, biangulate with slightly concave area between; spire straight sided. SUTURES deeply incised. SCULPTURE of three strong cords on early whorls, central first to emerge, closely followed by lower, and upper cord emerges on about fourth whorl; central cord gradually subsides, upper remains prominent, lower cord dominates throughout after about seventh whorl; numerous fine and coarse striations develop

at intervals, often up to 25 on penultimate whorl. APERTURE sub-circular, higher than wide; columella straight, inner lip reflected on to body-whorl as glazed callus; outer lip thin with typical sinus. BASE of shell flat with numerous strong striae crossed by numerous growth lines.

Type locality: River Murray Cliffs, 4 miles downstream from Morgan, South Australia.

Dimensions: Holotype, length 60 mm, breadth 17 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T.830 C.

Material: Large quantity from Australian Museum, Sydney; National Museum of Victoria, Melbourne; Tasmanian Museum, Hobart.

Discussion: This species has quite a long history in the Australian Tertiary, and may be found in quantity in many parts of Victoria and South Australia, and at Table Cape, Tasmania. I have compared many specimens from a number of localities with recent *M. roseus* (Quoy and Gaimard) from various parts of New Zealand, also with the few New Zealand fossil specimens available to me. The sculpture is decidedly variable, and the apical angle varies from 14° to as much as 24°. However the protoconch, the primary whorls with three strong keels, also the labial and basal sinus are quite constant throughout all specimens examined. There are strong grounds for considering *M. murrayanus* to be a synonym of *M. roseus*, however it would be necessary to examine a large quantity of specimens of both species of fossils, comparing each stage progressively to determine the matter, and the New Zealand specimens are not available to me. This is a study which could well be undertaken by a palaeontologist at a later date.

Maoricolpus tasmaniensis (Cotton and Woods, 1935)

Pl. 29, fig. 8.

1893 *Turritella acricula* var. Tate, *Trans. R. Soc. S. Aust.*, 17: 340, pl. 9, fig. 12.

1935 *Turritella* (*Gazameda*) *acricula tasmaniensis* Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 374, 376. Not figured.

Description: PROTOCONCH of 3 to 4 microscopic flatly globose whorls, apparently sinusigeroid, nucleus not seen. TELEOCONCH at least 13 whorls, first seven convex, balance flatly concave, ridged towards anterior end, spire straight sided. SUTURES finely but strongly incised. SCULPTURE — first whorl centrally corded, which later becomes a strong striation, second whorl develops another cord towards base, third whorl develops a third cord towards top, lowest of three remains dominant throughout; others follow until 7 or 8 cords of various sizes on penultimate with finer threads between; all are crossed by fine incremental striae. APERTURE sub-quadrate; columella slightly arcuate, inner lip slightly reflected at base; outer lip thin with typical sinus. BASE of shell slightly concave, with 9 or 10 strong concentric lirae, one or two finer threads between each, growth lines fine and numerous.

Type locality: Fossil Bluff, Table Cape, near Wynyard, Tasmania. Table Cape Group: Janjukian/Longfordian: Upper Oligocene/Lower Miocene.

Dimensions: Holotype, length 34 mm, breadth 8.3 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Regd. No. T. 1414B.

Turritellidae

Material: Three topotypes from National Museum of Victoria.

Discussion: This is one of the five species shown by Cotton and Woods (1935: 374, 376) under the genus *Gazameda*, with which it has no relationship. It is obviously related to *M. murrayanus* but cannot be classed as a subspecies owing to its smaller size, far bolder sculpture, and decidedly narrower length/width ratio, all points being consistent.

Maoricolpus subrudis (Cotton and Woods, 1935)

Pl. 29, fig. 9.

1935 *Turritella* (*Maoricolpus*) *murrayana subrudis* Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 371, text fig. 1.

1952 *Maoricolpus subrudis*. Crespin and Cotton, *Geol. Surv. S. Aust.*, Bull. 27, append. 4: 245.

1954 *Turritella* (*Peyrotia*) *murrayana subrudis*. Ludbrook, *Trans. R. Soc. S. Aust.*, 77: 59.

1957 *Turritella* (*Maoricolpus*) *murrayana subrudis*. Ludbrook, *Trans. R. Soc. S. Aust.*, 80: 19.

Description: PROTOCONCH unavailable, presumed to be as for the genus. TELEOCONCH 14 whorls, first five convex and medially angulate, balance flat or slightly medially concave, spire straight sided. SUTURES strongly incised, in places a little canaliculate. SCULPTURE commences gradually after first whorl, of densely packed and prominent striae, increasing to 16 on penultimate and with finer threads between; two stronger cords usually more prominent than others towards base of whorls. APERTURE sub-quadrate; columella slightly arcuate; outer lip thin with typical sinus. BASE of shell concave with numerous concentric striae, strong and fine alternating, crossed by numerous growth lines.

Type locality: Abattoirs Bore, near Adelaide, South Australia, 300-500 feet. Dry Creek Sands: Yatalan: Upper Pliocene.

Dimensions: Holotype, length 49 mm, breadth 12 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T. 1688.

Material: Four topotypes from National Museum of Victoria; one topotype from Australian Museum, Sydney.

Discussion: This species was shown by Cotton and Woods (1935: 371), as a subspecies of the larger *M. murrayanus* (Tate). Specimens available for study have the protoconch and first two or three primary whorls missing, but the following whorls do not conform to the sculpture of *M. murrayanus*, the usual three strong striae of that species being replaced by densely packed numerous striations, the different form of sculpture being quite consistent on all specimens examined. The prominent cord towards the base of whorls in *M. murrayanus* is also replaced in this species by two finer cords. It is considered that the differences are sufficient to warrant separation as a full species.

Genus *SPIROCOLPUS* Finlay, 1927

SPIROCOLPUS Finlay, 1927, *Trans. New Zeal. Inst.*, 57: 388. Type species by original designation *Turritella waihaensis* Marwick.

Generic characteristics: Medium, broad for length, fairly solid. Whorls flatly convex, spire straight sided. Aperture sub-circular to sub-quadrate. Base flat to slightly concave. Protoconch multispiral, conic, $2\frac{1}{2}$ flatly convex whorls, nucleus a little submerged. Labial sinus opisthocline, medial, extremely deep and narrow (Fig. 8). Primary spirals emerge in order B, C, A. Spiral cords fairly strong.

T. A. Garrard

FOSSIL SPECIES

Spirocolpus aldingae (Tate, 1882)

Pl. 29, fig. 10.

1882 *Turritella aldingae* Tate, *Trans. R. Soc. S. Aust.*, 5: 45.1893 *Turritella aldingae* Tate, *Trans. R. Soc. S. Aust.*, 17: 336, pl. 8, fig. 1.1912 *Turritella (Zaria) pritchardi* Cossmann, *Essais. de Paleo. Comp.*, 9: 199, pl. 8, fig. 6.

Description: PROTOCONCH of $2\frac{1}{2}$ flatly convex whorls, nucleus a little submerged, slightly asymmetric. TELEOCONCH 14 whorls, flatly convex, spire straight sided. SUTURES finely but deeply incised. SCULPTURE of three fine striae on primary whorls, which become progressively stronger cords with age, lowest the strongest, central becoming beaded; upper cord frequently divides into three closely packed smaller cords; several fine striations also develop on whorls in various positions; growth striae very faint on early whorls but show up strongly on last two or three. APERTURE sub-quadrate; columella arcuate, inner lip reflected at base; outer lip thin and crenulated exteriorly by cords, with typical sinus. BASE of shell flat, with heavy peripheral ridge, and a number of striae of various sizes crossed by faint growth lines. COLOUR — most specimens are chocolate in colour with a fairly high glaze.

Type locality: Adelaide Bore, Kent Town, South Australia. Blanche Point Marl: Aldingan: Upper Eocene.

Dimensions: Holotype, length 36 mm, breadth 10.5 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T.1406 B & G.

Material: 9 specimens, National Museum of Victoria, Melbourne, from Blanche Point Marl, Aldinga Bay, South Australia.

Discussion: This species has a somewhat similar sculpture on the mature whorls and a general similar facies to the recent *Colpospira (Acutospira) accisa* (Watson), but the far deeper labial sinus is an outstanding feature and sets it quite apart.

Genus *TURRITELLA* Lamarck, 1799

TURRITELLA Lamarck, 1799, *Soc. Hist. Nat.*, Paris, p. 74. Type species by original designation *Turbo terebra* Linnaeus.

Generic characteristics: Very large, heavy and solid. Whorls convex, spire straight sided. Aperture almost circular. Base roundly convex. Protoconch not known. Labial sinus a broad and very shallow curve, opisthocyrt or arched backward, continued as a straight line across base (Fig. 9). Primary spirals emerge in order B, A, C, with a secondary, soon rivalling B, commencing between A and B before C begins. Spiral cords medium to fairly strong.

Turritella terebra (Linnaeus, 1758)

Pl. 29, fig. 11.

1758 *Turbo terebra* Linnaeus, *Syst. Nat.*, ed. 12, p. 766.1849 *Turritella terebra*. Reeve, *Conch. Icon.*, 5, pl. 1, fig. 3.1849 *Turritella cerea* Reeve, *Conch. Icon.*, 5, pl. 6, fig. 25.1849 *Turritella spectrum* Reeve, *Conch. Icon.*, 5, pl. 8, fig. 40.

Turritellidae

- 1873 *Turritella terebra*. Kiener, *Coq. Viv.*, 9: 4, pl. 3, fig. 4.
 1886 *Turritella terebra*. Tryon, *Man. Conch.*, 8: 195, pl. 59, fig. 32.
 1950 *Turritella cerea*. Allan, *Aust. Shells*, p. 91, pl. 17, fig. 17.
 1957 *Turritella terebra*. Marwick, *Proc. Mal. Soc. Lond.*, 52: 161, text figs. 48, 49.

Description: PROTOCONCH unavailable. TELEOCONCH about 25 whorls, contracted above, bulbous toward base, spire straight sided. SUTURES fairly strongly incised. SCULPTURE commences with a sub-central cord on first whorl, followed by a second at top of whorl, another between these, then a fourth towards base; others follow at intervals, reaching about 14 on body whorl with a few fine threads between; three equal and strongest cords towards base, producing a broadly pear-shaped whorl. APERTURE almost circular, a little deeper than broad; columella arcuate, inner lip strongly reflected on to body-whorl as a glazed callus; outer lip together with base form one wide shallow sinus, moving in a shallow arc from upper suture, then across base of shell to columella. BASE of shell roundly convex with 6 or 7 strong lirae and 2 or 3 fine threads between each, crossed by straight growth lines. COLOUR light cream or fawn, often with darker axial flames; some tend to be quite dark in colour, commencing with light reddish-tinged whorls and finishing with body-whorl almost black. OPERCULUM simple, circular, black and polished, with a number of concentric growth ridges and sub-central nucleus.

Type locality: Generally accepted as Philippine Islands.

Dimensions: Maximum length of a fully mature specimen approx. 170 mm, maximum breadth approx. 44 mm. Holotype understood to be in possession of the Linnaean Society of London.

Distribution: Across the whole northern Australian coastline, and a short distance southwards along both east and west coasts.

Material: Numerous specimens from six State Museums.

Discussion: The wide shallow primitive type of sinus in this large species, which was widespread in the Cretaceous and early Tertiary, is by no means representative of the subfamily Turritellinae, but places it towards its outer limits. It is frequently confused with *Archimediella fastigiata* (Adams and Reeve), but the three strong cords towards the base of the whorls in *T. terebra* easily separate it from the two strong cords of *A. fastigiata* with the somewhat shallow concave section between. A feature noticed in many specimens is that the cords tend to disappear on the body-whorl of light coloured specimens, whilst they continue strongly on the bulk of those with very dark colouring.

Genus ZEACOLPUS Finlay, 1927

ZEACOLPUS Finlay, 1927, *Trans. New Zeal. Inst.*, 57: 388. Type species by original designation *Turritella vittata* Hutton.

Subgenus ZEACOLPUS ss.

Subgeneric characteristics: Medium to large in size and solid. Whorls flat, spire straight. Aperture sub-quadrate. Base flatly convex. Protoconch little more than one whorl, nucleus slightly submerged. Labial sinus prosocline, broad and moderately deep (Fig. 10). Primary spirals emerge in order B, C, A. Spiral cords fine to fairly strong.

Zeacolpus (Zeacolpus) vittatus (Hutton, 1873)

Pl. 29, fig. 12.

- 1873 *Turritella (Haustator) vittata* Hutton, *Cat. Mar. Moll. New Zeal.*, p. 29.
 1880 *Turritella (Haustator) vittata*. Hutton, *Man. New Zeal. Moll.*, p. 84.
 1881 *Turritella carlottae* Watson, *Jour. Linn. Soc. Lond.*, 15: 222.
 1886 *Turritella carlottae*. Watson, *Rep. Sci. Res. Challenger, Zool.*, 25: 478, pl. 30, fig. 5.
 1905 *Turritella carlottae*. Murdoch and Suter, *Trans. New Zeal. Inst.*, 38: 292.
 1913 *Turritella carlottae*. Hedley, *Proc. Linn. Soc. N.S.W.*, 38: 292.
 1913 *Turritella carlottae*. Suter, *Man. New Zeal. Moll.*, p. 266, pl. 39, fig. 19.
 1915 *Turritella vittata*. E. A. Smith, *Brit. Antarc. (Terra Nova) Exp.*, 1910, Vol. 2: 80.
 1957 *Zeacolpus vittatus*. Marwick, *Proc. Mal. Soc. Lond.*, 32: 161, text fig. 5, 56-59.

Description: PROTOCONCH paucispiral, asymmetric, little more than one whorl, nucleus erect. TELEOCONCH 12 whorls, flat, contracted at sutures, spire straight. SUTURES strongly incised. SCULPTURE of two strong cords on lower half of first whorl, upper the stronger, closely followed by two finer cords above; numerous finer striae develop at intervals some becoming prominent; body-whorl with six strong cords and up to 12 finer. APERTURE sub-quadrate; columella straight, inner lip reflected on to body-whorl; outer lip thin with typical sinus. BASE of shell flatly convex with several strong flat concentric striae and finer threads between, crossed by numerous growth lines. COLOUR yellowish-white to light reddish-brown with brown-topped major cords both on whorls and base. OPERCULUM circular, thin, flat, light yellow-brown, central nucleus, about 12 concentric growth lamellae.

Type locality: North Island, New Zealand.

Dimensions: Holotype, length 46 mm, breadth 12.7 mm, Dominion Museum, Wellington, New Zealand, Reg'd. No. 137.

Distribution: New Zealand generally. (?) Bass Strait.

Material: 15 specimens from various New Zealand localities in Australian Museum, Sydney.

Discussion: It is interesting to note that Watson mentions several mature specimens of "*carlottae*" from his type locality in 38-40 fathoms east of East Moncoeur Island, Bass Strait, and yet further specimens do not appear to have come to notice since that date. The species has been omitted from the Tasmanian Check-list, and Hedley (1913: 292) expressed doubts regarding its existence in Australian waters. No further specimens were obtained by H.M.A.S. "Gascoigne" in Bass Strait in 1962, which does not however prove its non-existence. As Watson obtained other specimens from Queen Charlotte Sound, New Zealand, the possibility cannot be overlooked that these were later mixed with other species of shells from the Bass Strait locality. In these circumstances its existence as an Australian species must still be regarded with doubt.

Subgenus *STIRACOLPUS* Finlay, 1927

STIRACOLPUS Finlay, 1927, *Trans. New Zeal. Inst.*, 57: 339. Type species by original designation *Turritella symmetrica* Hutton.

Subgeneric characteristics: Medium in size, light to heavy in weight. Whorls convex, spire straight. Aperture sub-circular. Base flatly convex. Protoconch of one to $1\frac{1}{2}$ flatly convex whorls, asymmetric, nucleus a little submerged. Labial sinus prosocline, broad and moderately deep (fig. 11).

Turritellidae

Primary spirals emerge in order B followed by A and C simultaneously. Spiral cords fine to very strong.

Zeacolpus (Stiracolpus) capricornius sp. nov.

Pl. 29, fig. 13.

Description: PROTOCONCH paucispiral, asymmetric, of $1\frac{1}{2}$ flatly convex white or translucent whorls, nucleus a little submerged. TELEOCONCH ten convex whorls, shining, spire straight. SUTURES slightly impressed. SCULPTURE of three main cords, commencing almost simultaneously on first whorl, central the strongest, followed by lowest, with uppermost the weakest; spirals continue in this strength until fifth or sixth whorl, when upper and lower become equal; one, two or three finer spirals between main cords commence about fourth whorl, and penultimate has about 12 of varied importance, all crossed by fine growth lines. APERTURE sub-circular; columella strongly arcuate, inner lip reflected at base; outer lip thin with broad, moderately deep medial sinus, typical of the genus. BASE of shell flatly convex with seven or eight strong but flat lirae crossed by numerous lines of growth. COLOUR light brown or chocolate, apart from white protoconch; there are no other markings. OPERCULUM unavailable.

Type locality: Dundowron Beach, north of Hervey Bay, southern Queensland.

Dimensions: Holotype, length 14.5 mm, breadth 4.5 mm, Australian Museum, Sydney, Reg'd. No. C.72584. Largest paratype, length 20 mm, breadth 6.2 mm.

Distribution: Type locality only.

Material: Holotype and five paratypes.

Discussion: This species has no near relatives in Australian waters, and its origins probably lie with one or other of the many New Zealand species or subspecies in the subgenus. It has been compared with several others from New Zealand which it appeared to resemble. However all New Zealand members of the group are more solidly constructed with decidedly heavier and coarser keels and striations, and this new species appears to be quite distinct. Although only six specimens are known to me from the type locality, they were collected, three personally, over a period of some five years, which appears to be definite proof that the species lives in the area. The tremendous distance that the tide recedes at the type locality owing to the almost flat and horizontal sea-bed in the area would account for the fact that so few of this small species would normally be washed up to the high tide mark or thereabouts.

Subfamily PAREORINAE Finlay and Marwick, 1937

Genus PAREORA Marwick, 1931

PAREORA Marwick, 1931, *New Zeal. Geol. Surv., Palaeon. Bull.*, 13: 94. Type species by original designation *Eglisia striolata* Hutton.

Generic characteristics: Very small and elongate. Whorls convex, spire convex. Aperture oval and oblique. Base flat or slightly convex. Protoconch conic and polygyrate. Labial sinus slightly opisthocline, broad but deep, and above centre of whorl (Fig. 13). Primary spirals emerge in order B, C, A. Spiral cords flat and narrow.

T. A. Garrard

FOSSIL SPECIES

Pareora stylacris (Tate, 1893)

Pl. 30, fig. 3.

1893 *Mesalia stylacris* Tate, *Trans. R. Soc. S. Aust.*, 17: 341, pl. 9, fig. 2.1935 *Pareora stylacris*. Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 382.

Description: PROTOCONCH multispiral, mamillate, microscopic, of four narrow convex whorls, nucleus slightly submerged. TELEOCONCH five whorls, convex and slightly medially angulated, spire slightly convex. SUTURES strongly impressed. SCULPTURE of four to seven flat narrow striae, mainly confined to anterior portion of whorls, crossed by microscopic somewhat sigmoid growth lines. APERTURE oval; columella thick, arched and flattened, joined by callus to outer lip, which is thin with typical sinus. BASE of shell flat or slightly convex, smooth except for incremental growth striae.

Type locality: Blanche Point, Aldinga Bay, South Australia. Blanche Point Marl: Aldingan: Upper Eocene.

Dimensions: Holotype, length 4 mm, breadth 2 mm, Tate Museum, Geology Dept., University of Adelaide, South Australia, Reg'd. No. T.1442.

Material: 4 topotypes National Museum of Victoria, Melbourne.

Discussion: This unusually shaped species, more reminiscent in general facies of some Pyramidellidae or Melanellidae groups, is the only known Australian member of the genus, its polygyrate protoconch and aperture continuous with the columella being consistent with the original generic description. It does not appear to have any recent descendants.

Genus ZARIA Gray, 1847

ZARIA Gray, 1847, *Syn. Cont. Brit. Mus.*, ed. 42: 147. Type species by original designation *Turbo duplicatus* Linnaeus.

Generic characteristics: Very large, heavy and solid. Whorls convex, spire straight sided. Aperture sub-circular, inclined to pyriform. Base convex and withdrawn in to columella. Protoconch unknown. Labial sinus prosocline, formed of wide arc from upper suture round edge of base (Fig. 12). Primary spirals emerge in order C, B, A. Mature spirals consist of strong sharp keels.

Zaria duplicata (Linnaeus, 1758)

Pl. 29, fig. 14.

1758 *Turbo acutangulus* Linnaeus, *Syst. Nat.*, ed. 10: 766, sp. 559; *ibid.*, *T. duplicatus* Linnaeus, p. 766, sp. 560.

1767 *Turbo acutangulus*. Linnaeus, *Syst. Nat.*, ed. 12, sp. 642; *ibid.*, *T. duplicatus* Linnaeus, sp. 643.

1843 *Turritella duplicata* Lamarck, *Hist. Anim. s. Vert.*, 9: 251.

1847 *Zaria duplicata*. Gray, *Syn. Cont. Brit. Mus.*, ed. 42: 147.

1849 *Turritella duplicata*. Reeve, *Conch. Icon.*, 5, pl. 1, fig. 2; *ibid.*, *T. acutangulus*, pl. 1, fig. 2. (Ref. as synonym).

1873 *Turritella duplicata*. Kiener, *Coq. Viv.*, 9: 3, pl. 1, 3 figs.; pl. 2, figs. 2a, 2b.

1886 *Turritella duplicata*. Tryon, *Man. Conch.*, 8: 207, pl. 65, figs. 20-22.

1957 *Zaria duplicata*. Marwick, *Proc. Mal. Soc. Lond.*, 32: 164, text figs. 40, 47.

Description: PROTOCONCH unavailable. TELEOCONCH 16 whorls, contracted above, bulbous towards base, spire slightly convex. SUTURES

Turritellidae

deeply impressed. SCULPTURE of three strong sharp spiral keels towards base and three finer above for about first ten whorls, after which anterior of the three strong spirals tends to fade, other two decidedly stronger and more sharply ridged, but these often fade out on body-whorl. APERTURE sub-circular, inclined to pyriform; columella strongly arcuate; outer lip sweeps in wide arc from upper suture to base, then reverses direction and swings in further wide arc to columella, where it forms a spiral ridge crossing it towards top of aperture. BASE of shell smooth, convex and withdrawn in towards the columella. COLOUR light reddish-cream, upper part of whorls somewhat darker. OPERCULUM circular, dark brown to black, about 12 mm diameter in fully grown specimens, sub-central nucleus, up to seven concentric lamellae with raised edges, each lamellation showing oblique growth lines.

Type locality: "Eastern Seas."

Dimensions: Reeve's figured specimen measures 171 mm, length, 42 mm breadth, which appears to be the maximum to which the species grows. Holotype understood to be in possession of the Linnaean Society of London.

Distribution: In Australia the species occurs across the north of the continent, from the far north of Western Australia to Cape York Peninsula, Queensland.

Material: Large number of specimens from five State Museums.

Discussion: This very large, heavy and massive species cannot be confused with any other in the family, and little variation is apparent except the greater or lesser prominence of one or two of the main keels. In the original description of *T. acutangulus* Linnaeus and *T. duplicatus* Linnaeus, (1758: 766) the former name takes page precedence. However the description of *T. acutangulus* is that of an aberrant specimen, is misleading and not indicative of the species. This was apparently realised by Linnaeus and the numbers 642 and 643 were both marked on the one specimen in his collection, the numbers referring to the two species. The above specimen, which is the *T. duplicata* of modern writers, was well presented by Chemnitz (*Conch. Cab.*, 4, pl. 151, fig. 1414). This observation was made by Hanley (1855: 347).

Subfamily TURRITELLOPSINAE Marwick, 1957

Genus GLYPTOZARIA Iredale, 1924

GLYPTOZARIA Iredale, 1924, *Proc. Linn. Soc. N.S.W.*, 49: 248. Type species by original designation *Turritella opulenta* Hedley.

Generic characteristics: Very small and frail. Whorls convex, spire straight sided. Aperture sub-circular to pear shaped. Base flatly convex to flatly concave. Protoconch slightly asymmetric, $1\frac{1}{2}$ whorls, flatly convex, nucleus submerged. Labial sinus a wide shallow arc slightly opisthocline (Fig. 14). Primary spirals — B and C emerge simultaneously from junction of first main whorl with protoconch, B being the stronger, and C emerges about fourth whorl. Sculpture of spiral and axial cords of about equal strength, forming a cancellated sculpture.

Glyptozaria opulenta (Hedley, 1907)

Pl. 29, fig. 15.

- 1907 *Turritella opulenta* Hedley, *Rec. Aust. Mus.*, 6:292, pl. 54, fig. 9.
 1924 *Glyptozaria opulenta*. Iredale, *Proc. Linn. Soc. N.S.W.*, 49: 248.
 1925 *Glyptozaria opulenta*. Iredale, *Rec. Aust. Mus.*, 14: 267.
 1931 *Glyptozaria opulenta*. Cotton and Godfrey, *S. Aust. Naturalist*, 12: 59, pl. 2, fig. 5.
 1950 *Glyptozaria opulenta*. Allan, *Aust. Shells*, p. 92.
 1951 *Glyptozaria opulenta*. Laseron, *Rec. Aust. Mus.*, 22: 333, fig. 91.
 1957 *Glyptozaria opulenta*. Marwick, *Proc. Mal. Soc. Lond.*, 32: 164, text figs. 69, 70.

Description: PROTOCONCH paucispiral, a little asymmetric, of $1\frac{1}{2}$ whorls, with large but well submerged nucleus. TELEOCONCH eight whorls, convex, deeply indented at sutures, spire straight. SUTURES lightly impressed within a deep channel between whorls, often with a fine thread on one or both sides. SCULPTURE — two strong spiral cords on first whorl, three from fourth whorl onwards, central the most prominent; a fine thread frequently present between spirals; all are crossed by fairly closely packed axial ribs forming gemmulations on spirals; axial ribs follow slight curve of outer lip. APERTURE almost pear-shaped; columella and inner lip strongly arcuate; outer lip, crenulated by cords, flares outwards at base, then curves inwards to form an open canal at junction with base of columella. BASE of shell flatly convex, bordered by a strong peripheral rib, about five concentric striae crossed by faint growth lines. COLOUR off-white to light fawn, somewhat translucent when in good condition; irregular light brown marbling visible in places on some specimens. OPERCULUM not available.

Type locality: Off Cape Three Points, New South Wales, 41-50 fathoms (72-92 metres).

Dimensions: Holotype, length 6 mm, breadth 2 mm, Australian Museum, Sydney, Reg'd. No. C.16764.

Distribution: From Broken Bay, New South Wales, southwards to Victoria, Tasmania and South Australia, in known depths from 115 to 155 metres.

Material: Fair quantity from four State Museums.

Discussion: The sculpture of this species is subject to variation, the axial ribbing predominating in some specimens and the spiral in others. The placing of this species and other *Glyptozaria* species in the family Turritellidae is open to doubt. The outer lip at maturity is strongly reminiscent of certain Cerithiidae, and the short open canal at its junction with the base of the columella is often half-way to the typical anterior canal of that family. The genus is very close to the border line, and discovery of other similar species in future may warrant the establishment of a separate family between the two.

Glyptozaria columnaria Cotton and Woods, 1935.

Pl. 29, fig. 16.

- 1935 *Glyptozaria columnaria* Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 382, text fig. 5 (p. 377).

Description: PROTOCONCH paucispiral, slightly asymmetric, of $1\frac{1}{2}$ depressed globose whorls, nucleus submerged. TELEOCONCH ten whorls,

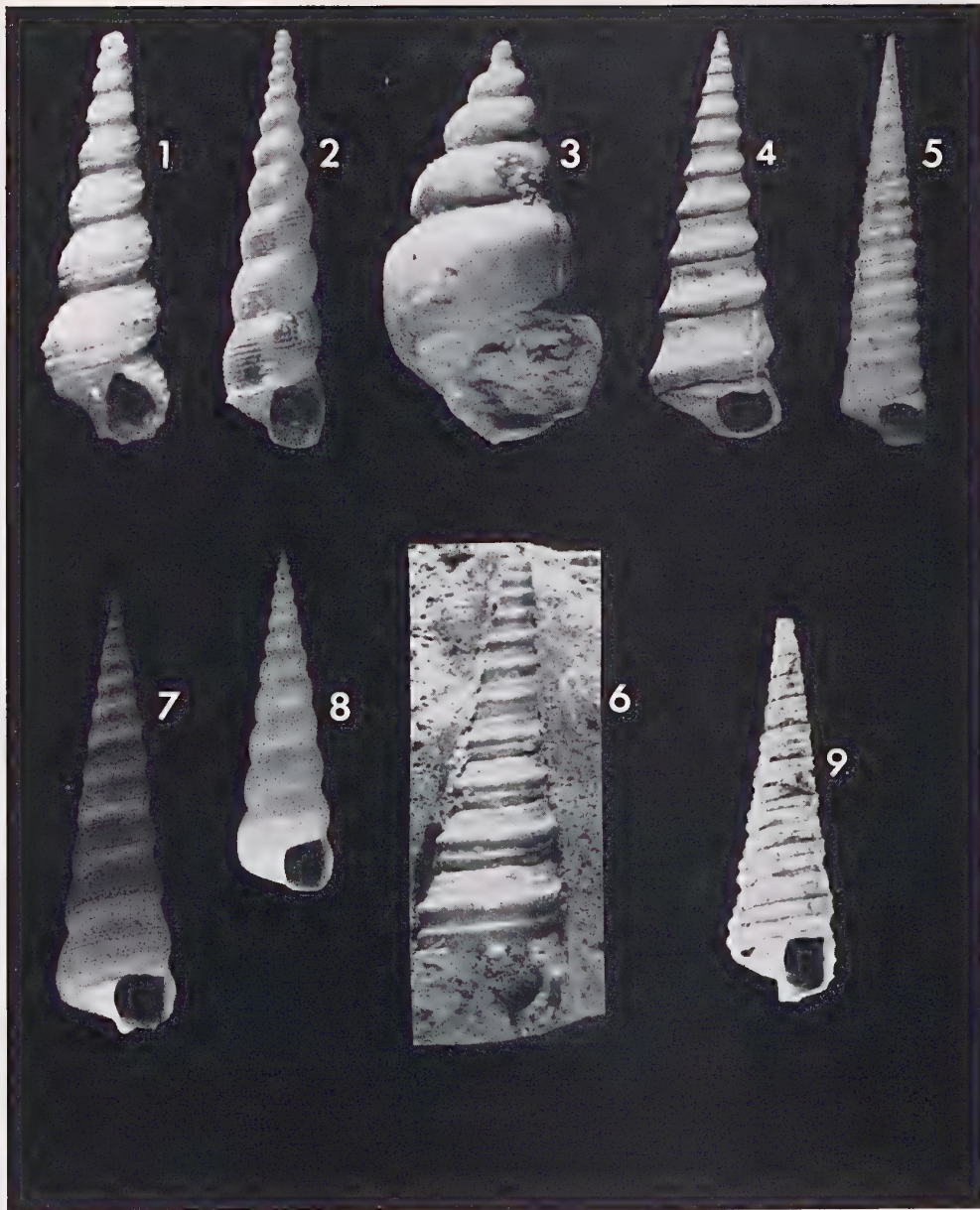


PLATE 30

1. *Kimberia kimberi* (Verco). South of Cape Carnot, South Australia, 170 metres. Figured specimen, X 21. A.M. No. C77387.
2. *Kimberia neptunensis* (Verco). Off Cape Everard, Victoria, 54 metres. Figured specimen, X 8.9. A.M. No. C77388.
3. *Pareora stylacris* (Tate). Lower 6-15 feet of cliffs, Blanche Point, Aldinga Bay, South Australia. Topotype, X 15.3. N.M.V. No. P27000.
4. *Colpospira (Ctenocolpus) pagodula* (Tate). Cutting on Prince's Highway, Jemmys Point, Kalimna, Victoria. Figured specimen, X 5.8. N.M.V. No. P26998.
5. *Gazameda declivis* (Adams and Reeve) (G. "captiva" (Hedley)). North-east of Cape Moreton, southern Queensland, 114-123 metres. Figured specimen, X 1.2. A.M. No. C77379.
6. *Colpospira (Platycolpus) medioplicatilis* (Chapman and Crespin). Sorrento Bore (Nepean No. 1), Victoria, 1,461 feet. Paratype, X 11.9. N.M.V. No. P27003.
7. *Archimediella fastigiata* (Adams and Reeve). West of Flat Island, near Onslow, Western Australia, 11-18 metres. "Onslow forma," intermediate form. Figured specimen, X 2.2. A.M. No. C77385.
8. *Archimediella fastigiata* (Adams and Reeve). West of Flat Island, near Onslow, Western Australia, 11-18 metres. "Onslow forma," extreme form. Figured specimen, X 2.1. A.M. No. C77385.
9. *Colpospira (Platycolpus) warburtonii* (Tenison-Woods). Lower bed, Fossil Bluff, Table Cape, near Wynyard, Tasmania. Topotype, X 4.3. A.M. No. C77410.

convex, constricted posteriorly, spire slightly convex. SUTURES slightly canaliculate. SCULPTURE of two prominent cords commencing on first whorl, crossed by numerous rather faint axial riblets, about 24 on body whorl, rendering cords somewhat nodular; cords situated sub-centrally at anterior end of whorls, with a third cord at base of body-whorl. APERTURE sub-circular; columella straight; outer lip thin, a little crenulated exteriorly. BASE of shell smooth. COLOUR light cream. OPERCULUM unknown.

Type locality: 100 fathoms (182 metres) off Cape Pillar, southern Tasmania.

Dimensions: Holotype, length 4.5 mm, breadth 1.5 mm, South Australian Museum, Adelaide, Reg'd. No. D.11438.

Distribution: The only other known record apart from the type locality is 77 metres, south of Wilson Inlet, Western Australia.

Material: Two specimens only as mentioned above.

Discussion: Dredging undertaken by the author in many parts of southern Tasmania in recent years in depths down to about 50 metres has failed to produce a single specimen of this small species, which is apparently confined to deeper water. However the one other record from Western Australia indicates that its occurrence is fairly widespread.

FOSSIL SPECIES

Glyptozaria transenna (Tenison-Woods, 1879)

Pl. 29, fig. 17.

1879 *Turritella transenna* Tenison-Woods, *Proc. Linn. Soc. N.S.W.*, 3: 234, pl. 20, fig. 8.

1893 *Turritella transenna*. Tate, *Trans. R. Soc. S. Aust.*, 17: 335.

Description: PROTOCONCH paucispiral, slightly asymmetric, of $1\frac{1}{2}$ convex flatly compressed whorls, nucleus well submerged. TELEOCONCH nine whorls, slightly convex, spire straight. SUTURES finely incised. SCULPTURE of two or three strong spiral cords on each whorl, other minor cords later forming between, crossed by numerous almost vertical axial riblets forming gemmulations. APERTURE sub-circular; columella arcuate, inner lip strongly reflected and forming umbilical chink below columella; outer lip with gently curved shallow arc from upper suture to base. BASE of shell fairly concave, bordered by gemmate cord and with six or seven strong lirae crossed by fine densely packed growth lines.

Type locality: Muddy Creek, west of Hamilton, Victoria. Lower beds. Muddy Creek Formation: Balcombian: Middle Miocene.

Dimensions: Holotype, length 8.5 mm, breadth 3 mm, Australian Museum, Sydney, Reg'd. No. F.1701.

Material: Holotype as above, 3 topotypes National Museum of Victoria, Melbourne.

Discussion: Tenison-Woods' original description is rather misleading, stating of the cords "two large and three small alternating," whereas specimens have major and minor cords in different order on each of four specimens examined, which includes the holotype. In addition the axial

Turritellidae

riblets were mentioned as somewhat sloping and not passing over the cords, whereas they are practically vertical and pass over all spiral cords, large and small, rendering them decidedly gemmulate. The periphery was also mentioned as "margined with double line of small keels" but has one large cord only. The four specimens examined were all from the type locality.

The possibility exists that this species could be directly ancestral to *G. opulenta* Hedley. The main points of difference are that *G. opulenta* is a little narrower for its length, is more deeply channelled at the sutures, and has a pear-shaped aperture instead of sub-circular.

Genus *KIMBERIA* Cotton and Woods, 1935

KIMBERIA Cotton and Woods, 1935, *Rec. S. Aust. Mus.*, 5: 370. Type species by original designation *Turritella kimberi* Verco.

Generic characteristics: Very small, frail and translucent or clear. Whorls convex, spire straight or slightly convex. Aperture elongate-oval to sub-quadrangle. Base convex and smooth. Protoconch three to four minute whorls, nucleus not submerged. Labial sinus absent. Primary spirals emerge in order B, C, A, spiral B remaining dominant throughout. Sculpture of fairly strong keels, becoming flatter with age.

Kimberia kimberi (Verco, 1908)

Pl. 30, fig. 1.

- 1908 *Turritella kimberi* Verco, *Trans. R. Soc. S. Aust.*, 32: 342, pl. 15, figs. 14, 15.
 1931 *Stiracolpus kimberi*. Cotton and Godfrey, *S. Aust. Naturalist*, 12: 59.
 1935 *Kimberia kimberi*. Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 370.
 1957 *Kimberia kimberi*. Marwick, *Proc. Mal. Soc. Lond.*, 32: 164, text fig. 53.

Description: Protoconch narrowly conic with four tall whorls and small deviated emergent nucleus. TELEOCONCH eight convex whorls, spire straight sided. SUTURES lightly impressed. SCULPTURE — three spiral cords commence simultaneously after junction with protoconch on specimens examined; two others follow later making five on penultimate; extremely fine growth lines barely visible. APERTURE elongate oval; columella arcuate, inner lip reflected as callus on body-whorl; outer lip curves in an arc from upper suture to form a narrowly patulous base to aperture. BASE of shell convex and smooth. COLOUR translucent white. OPERCULUM unavailable.

Type locality: Backstairs Passage, South Australia, 20 fathoms (36 metres).

Dimensions: Holotype, length 7.7 mm, breadth 1.7 mm, South Australian Museum, Adelaide, Reg'd. No. 13427.

Distribution: Appears to be confined to South Australia.

Material: Holotype and several paratypes South Australian Museum, several paratypes National Museum of Victoria, six specimens Australian Museum, Sydney.

Discussion: This small species is a little variable, the type possessing six spiral ribs on penultimate whorl, the co-type in the National Museum of Victoria has five, a specimen from 170 metres south of Cape Carnot, South Australia, has nine. The protoconch of the last specimen has

about 22 narrow ribs on all whorls of protoconch, more or less vertical above, inclined to right below, which gradually disappear on first main whorl and which are not present on holotype.

Kimberia neptunensis (Verco, 1910)

Pl. 30, fig. 2.

1910 *Turritella neptunensis* Verco, *Trans. R. Soc. S. Aust.*, 34: 120, pl. 30, fig. 7.

1931 *Stiracopus neptunensis*. Cotton and Godfrey, *S. Aust. Naturalist*, 12: 59.

1935 *Kimberia neptunensis*. Cotton and Woods, *Rec. S. Aust. Mus.*, 5: 370.

Description: PROTOCONCH minute, narrowly conic, three flatly convex whorls, nucleus slightly submerged, first two whorls smooth, third faintly axially striate. TELEOCONCH nine whorls, first six medially angulate, next two convex, spire slightly convex. SUTURES lightly impressed, faintly margined. SCULPTURE of strong medial cord on first six whorls, accompanied by several minute lirae, which flatten out to become rather obsolete, mostly towards centre of whorls, and show through shell into aperture. APERTURE sub-quadrate, columella straight, inner lip reflected at base; outer lip thin with a slight overall concavity. BASE of shell smooth and rounded. COLOUR transparent to translucent white. OPERCULUM if any unavailable.

Type locality: Neptune Island, South Australia, 35 miles south-west, 104 fathoms (190 metres).

Dimensions: Holotype, length 6 mm, breadth 1.4 mm, South Australian Museum, Adelaide, Reg'd. No. D.13428.

Distribution: From north of Cape Moreton, southern Queensland, through New South Wales and Victoria to South Australia, in depths ranging from 115 to 550 metres.

Material: Holotype, several paratypes and a number of other specimens from three State Museums.

Discussion: The resemblance of this species to *K. kimberi*, as noted by the author in his original diagnosis, is further emphasized by the presence of axial striations on the third whorl of the protoconch. This feature has been noted in discussion of a specimen of *K. kimberi* which precedes this species. Although *K. kimberi*, so far as known at present, appears to be confined to South Australia, the within species is far more widespread as shown above.

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INDEX TO SPECIES

Valid names are in italics.

Fossil species and synonyms are preceded by an asterisk.

	page		page		page
<i>accisa</i>	295	<i>fragilis</i>	318	* <i>platyspiroides</i>	294
* <i>acinella</i>	302	<i>fusco-tincta</i>	318	* <i>pritchardi</i>	326
* <i>acricula</i>	314	* <i>gemmulata</i>	309	<i>quadrata</i>	299
<i>acuta</i>	313	<i>godeffroyana</i>	296	<i>reevei</i>	284
<i>acutangulus</i>	330	<i>gracillima</i>	318	<i>roseus</i>	322
* <i>adelaidensis</i>	316	<i>granulifera</i>	305	<i>runcinata</i>	277
* <i>aldingae</i>	326	<i>guillaumei</i>	308	<i>scitula</i>	299
<i>aquamarina</i>	278	<i>gunnii</i>	310	* <i>septifragus</i>	323
<i>atkinsoni</i>	296	<i>higginsii</i>	277	<i>sinuata</i>	286
<i>australis</i>	305	<i>incisa</i>	287	<i>smithiana</i>	297
<i>bicolor</i>	318	<i>indigena</i>	283	<i>sophiae</i>	287
<i>bundilla</i>	278	<i>iredalei</i>	312	<i>spectrum</i>	326
* <i>calcaria</i>	291	<i>joannae</i>	284	* <i>sturtii</i>	301
<i>capricornius</i>	329	<i>kimberi</i>	335	* <i>stylacris</i>	330
<i>captiva</i>	311	<i>lamellosa</i>	313	* <i>subacricula</i>	317
<i>carlottae</i>	328	* <i>latissima</i>	323	* <i>subrudis</i>	325
<i>cerea</i>	326	<i>leeuwinensis</i>	319	<i>subsquamosa</i>	313
<i>cingulifer</i>	318	<i>maculata</i>	275	<i>sutoris</i>	277
<i>circumligata</i>	300	* <i>manyung</i>	315	<i>tasmanica</i>	313
<i>clathrata</i>	312	<i>medioangulata</i>	296	<i>tasmanica</i>	296
<i>columnaria</i>	332	<i>mediolevis</i>	285	* <i>tasmaniensis</i>	324
<i>congelata</i>	301	* <i>medioplicatilis</i>	303	<i>tennilirata</i>	277
* <i>conspicabilis</i>	292	<i>moretonensis</i>	286	* <i>terebellata</i>	305
<i>cordismei</i>	279	* <i>multicincturalis</i>	303	<i>terebra</i>	326
<i>crenulata</i>	284	* <i>murrayanus</i>	323	* <i>transenna</i>	334
<i>curialis</i>	306	<i>neptunensis</i>	336	<i>translucida</i>	288
<i>declivis</i>	311	<i>occidua</i>	276	<i>tricarinata</i>	318
<i>decoramen</i>	282	<i>opulenta</i>	332	* <i>trilix</i>	304
<i>deliciosa</i>	283	<i>ornata</i>	275	* <i>tristira</i>	290
<i>diffidens</i>	305	<i>oxyacris</i>	313	* <i>victoriensis</i>	315
<i>dirkhartogensis</i>	273	* <i>pagodula</i>	309	<i>vittatus</i>	328
<i>duplicata</i>	330	<i>parva</i>	318	* <i>warburtonii</i>	301
<i>fascialis</i>	318	<i>philippensis</i>	310	<i>wollumbi</i>	289
<i>fastigiata</i>	274	* <i>platyspira</i>	291	<i>yarramundi</i>	298